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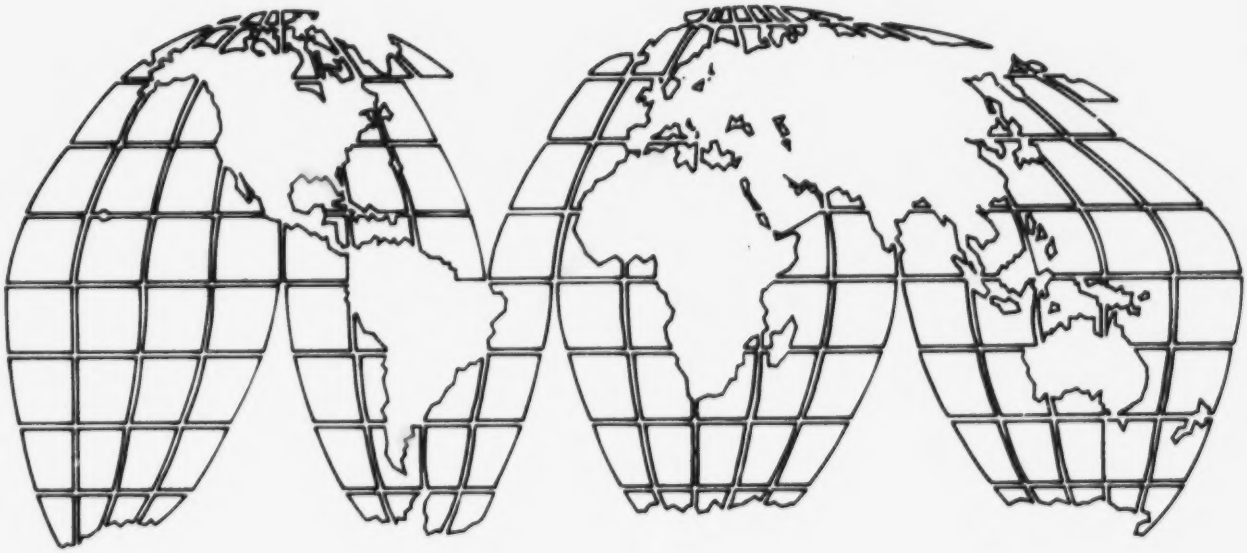
ORIGINAL

A.I.D. Program Evaluation Discussion Paper No. 7

Socio-Economic and Environmental Impacts of Low Volume Rural Roads

A Review of the Literature



February 1980

Office of Evaluation
Bureau for Program and Policy Coordination
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I

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SOCIO-ECONOMIC AND ENVIRONMENTAL IMPACTS OF LOW-VOLUME RURAL ROADS-- A REVIEW OF THE LITERATURE

by
Devres, Incorporated

A.I.D. Program Evaluation
Discussion Paper No. 7

The Studies Division
Office of Evaluation
Bureau for Program and Policy Coordination
U.S. Agency for International Development

February 1980

The views and interpretations expressed in this report are those of the authors and should not be attributed to the Agency for International Development.

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PREFACE

The A.I.D. Program Evaluation Discussion Paper Series: Office of Evaluation Approach.

This is one of a series of discussion papers issued by the Agency for International Development. This paper is sponsored by the Office of Evaluation.

The purpose of the A.I.D. Program Evaluation Discussion Paper Series is to stimulate thought and dialogue on development problems and to encourage experimentation. The authors of the papers are instructed to be critical in a constructive sense and to examine explicit or implicit assumptions that are usually taken as given, to look for unrecognized and often cross-sectoral linkages, to examine host country institutional factors, to examine how AID's organization, staffing and procedures affect its effectiveness, and to identify alternative approaches and policy options. Two key factors characterize the series: actual development experience is sought as a basis for opinion and opinion is directed towards policy issues. The papers are a mix of what is known (from experience and evaluation evidence) and what needs to be known from further evaluative studies.

Because the discussion papers are exploratory, they are not intended to be comprehensive in coverage, conclusive in their argument, or primarily technical in orientation. They are intended to help formulate additional hypotheses for testing and to assess what additional work needs to be done on the problem. We hope that the discussion papers will help stimulate innovative and more effective programming and project design in our overseas missions and that they will also be of interest to scholars carrying out research on development.

Most importantly, however, we hope that the papers will elicit responses from our readers--responses that will confirm or refute assertions, refine or add issues to be analyzed, and suggest case studies necessary to resolve issues.

The primary objective of the Office of Evaluation is to provide AID management with analyses of the intended and unintended impact of projects, programs, policies, and procedures. It is our intent that lessons gleaned from AID's past be made readily available to improve present planning.

The Office tailors its approach to suit the nature of a problem, its urgency, and the type of data available. After identifying a problem and ascertaining management interest in it, the Office's staff normally links up with or establishes a network of AID and non-AID experts. The staff also reviews information from the Agency's automated data base systems and assembles documents including project papers, project evaluations, and special studies sponsored by other parts of the Agency. In conjunction with this, the Office commissions discussion papers by experts who are familiar with development problems. It may also hold workshops and conferences and, if necessary, carry out field studies of past projects and programs. The Office does not sponsor basic research on development but concentrates on analyzing available information.

Findings are issued in discussion papers, workshop and conference reports, circular airgrams, action memoranda, sector and subsector studies and case studies. These do not constitute formal guidance unless they are explicitly cleared and issued as such.

About This Paper

A.I.D. has selected rural roads as an area for concentration in its current evaluation activities. In March 1979 a paper by Dr. Judith Tendler, "New Directions Rural Roads" was published as AID Program Evaluation Discussion Paper No. 2. That paper examines the choices between equipment-based and labor-based rural road construction and the institutional questions involved in promoting labor-based roads.

The paper reflects renewed A.I.D. interest in learning the impacts of development projects. The consulting firm of Devres, Inc., was requested to review and synthesize the available academic literature and evaluation documents emanating from donor organizations. The study reviews the issues concerning the impacts of rural roads projects and indicates areas of agreement and disagreement on what those impacts are. A.I.D. is grateful to the authors of the study--Alain Y. Dessaint, Beth A. Jackson, Keith L. Oberg, Dennis H. Wood, and Charlotte DeBruhl--for their fine work on this report.

EXECUTIVE SUMMARY

A. Purpose

The purpose of this study is to:

- o survey the literature to determine the socio-economic and environmental impact of low-volume rural roads in developing countries;
- o identify major unanswered questions regarding the impacts of such roads;
- o raise issues regarding the impact of rural roads for consideration by AID in its planned ex-post evaluation study of rural road projects it has financed.

B. Procedures

The study was carried out by gathering, reviewing and analyzing available literature on the socio-economic and environmental impacts of rural roads. As a part of the analysis, an effort was made to place the study in a historical context and to provide an overview of the methods, approaches, assumptions and criteria used by those who have attempted to develop and evaluate low-volume rural road projects in developing countries (Chapter I.)

The impacts of rural roads as expressed in the literature were organized and analyzed in terms of impact categories (Chapter II.)

These categories are somewhat arbitrary and some impacts spill over into several of them. They do, however, help provide a conceptual framework for considering the various effects of rural roads.

The same impact categories were used to organize and summarize the results of the literature survey and analysis in Chapter III. The conclusions reached are stated primarily in terms of what appears to be known about the impact of rural roads (as noted in the literature), causal relationships and the population groups principally affected. Unanswered questions and issues were derived primarily by noting important areas of disagreement about the impact of rural roads in the literature. In numerous cases, however, questions and issues were also framed because certain impact areas were not dealt with in the literature at all or in a definitive way. Issues for which evidence is most likely to be available from rapid field visits were also identified in Chapter III.

C. Impacts

Basically, the impacts set out in the following sections are conclusions that can be drawn about the impacts of rural roads as a result of thorough review of the literature. They comprise what is known about the socio-economic and environmental impact of rural roads.

1. Agricultural production and crop composition

Roads almost inevitably lead to at least some agricultural production increases, especially where complementary inputs are provided; the majority of the population did not previously live close to a road; transport is competitive; and cost of transport of agricultural produce is high as a percentage of price.[1] The large, wealthier farmers, who are most likely and able to take advantage of new inputs, are able to benefit most from the introduction of roads.

Roads influence crop composition by enabling farmers to respond better to market opportunities. Subsistence farming generally yields to commercial farming, especially on land closer to roads and markets, but the rate and extent of the switch is influenced by numerous non-economic variables. Apart from basic market demand factors, the major variables in determining which cash crops are produced are perishability and the relative magnitude of transport cost savings. Production of crops which are perishable and require speedy marketing and/or which are transport-intensive generally increase the most following the construction of roads and the consequent lowering of transport time and costs.

2. Technology

Rural roads play a significant role in expanding the use of new agricultural tools, machines, fertilizers, pesticides and new

---

[1]Professor Roy Prosterman, University of Washington, has charged, however, that rural road projects in Bangladesh endanger agricultural production by taking valuable land out of production. (Testimony before the Senate Foreign Operations Committee, April 5, 1979.)

modes of transportation by making them better known, more accessible, and more reliable in delivery. Wealthier producers who could afford the often expensive and novel technologies benefit most from the new technology. The net effect of the road and technology is usually to aggravate income disparities unless complementary programs are put in place to offset the tendency.

3. Agricultural service institutions

Rural roads encourage the establishment of government service facilities and private cooperatives and facilitate visits by government agricultural extension agents. This is because they increase accessibility to the region and increase the effectiveness of the demands of the local population. The major beneficiaries appear to be the larger farmers who often control the local cooperatives, and are best situated to take advantage of extension advice and programs.

4. Agro-industrial, industrial and commercial enterprises

Agro-industrial, industrial and commercial enterprises increase along the road corridor as well as in communities newly serviced by the roads. Increased availability of road materials, access to markets for finished products and reduced transportation costs encourages this expansion. It can hurt cottage industries which suffer from the competition offered by cheap manufactured goods now transported into the area because of the road.

5. Employment

Where labor-based road construction takes place, rural roads stimulate short-term employment, directly and in construction-related activities, such as feeding and servicing the labor crews.

Roads promote medium- and long-term employment by increasing the skills and subsequent employability of those who worked on road construction and maintenance, by enabling commuting to nearby communities for casual paid work, and by stimulating regional production and commerce. Opportunities for women in handicrafts and vending have in some cases broadened. However, the displacement of porters, cart drivers and others engaged in traditional modes of transportation, together with more general disruption of the social and economic community structure, can encourage out-migration, particularly of young men, toward areas of greater employment opportunity. The manner in which these two opposing forces balance out in any particular area depends upon the specific "push" and "pull" factors which are operating.

6. Land values, tenure and use

The introduction of low-volume rural roads leads to increased land values, more intensive land use and a greater number of land transactions in direct proportion to the distance of the land from the road. Settlement along the road increases, residential and commercial use increases, and sometimes entire communities relocate from more remote areas. Land retained for agricultural use is generally put

under more intensive cultivation, particularly of high-bulk and/or perishable cash crops which can be more profitably marketed owing to the improved and less expensive transport. The wealthier entrepreneurial class is most able to take advantage of and benefit from such changes.

The few documented cases where shifts in ownership did not occur were where land tenure was relatively open and equitable, where little land speculation existed due to the high social value placed on land (and hence a reluctance to sell), and where specific development programs counteracted these tendencies.

7. Transport costs

Improvements in road conditions usually lower transport costs directly and by reducing time expenditures for travel, enabling use of motorized vehicles and encouraging competition among bus and trucking firms. The new lower costs are enjoyed by all road users for passenger transport as well as freight movement, but the new modes of transportation are, at times, out of the economic reach of the poor. In some cases, middlemen or transport monopolies absorb the savings and do not pass them on to consumer and producer. However, if transport costs represent a small percentage of total product costs, any transport savings will usually have minimal impact on marketing and production activities.

8. Marketing patterns

Marketing activities increase and new marketing patterns arise with road improvements and easier access to markets. Those farmers closest to the road and market generally tend to bypass the middleman, performing the market function themselves in order to realize higher income. Low-volume marketing activities tend to increase alongside the road, often increasing the role of women. The largest beneficiaries of increased farmer marketing activity are the large cash crop producers and those close to the market center, although marketing activities for small farmers also rise.

9. Consumption patterns

Rural roads increase the availability and use of consumer goods, social travel and recreational activities as the money economy penetrates the area and travel time and distance decreases. Roads encourage the introduction of imported goods and values (e.g., consumerism) in previously isolated areas by raising incomes, lowering transport costs and increasing contact with urban areas. Benefits from roads, however, are not evenly distributed, and the ability to increase consumption varies. Better-off rural inhabitants are more able to fulfill their new consumer needs/desires. The ability of the poor to participate in these new consumption patterns is often marginal, increasing their frustrations and/or diverting their consumption away from basic material and nutritional needs toward superfluous desires.

10. Health and nutrition

Rural roads increase access to health centers and specialists for routine health services as well as emergency assistance. However, the degree to which people actually take advantage of the health services is not clear. Also, access to health facilities may lead to an emphasis on curative medicine to the detriment of preventive measures such as a balanced diet or appropriate living conditions.

Provision of rural roads indirectly affects nutrition by facilitating a switch from subsistence to cash crop production. Family dependence for nutrition may change from the traditional home-grown diet to food purchased in retail outlets which may not be of equal nutritional value.

Roads, by encouraging mobility and mixture of peoples and goods, can be transmitters of insect-borne and communicable diseases. This consequence of roads is not well understood or documented, yet its impact can be devastating.

11. Education

The impact of rural roads on education is not clear-cut. Roads facilitate access for both teachers and pupils, but if no programs exist to open new schools or expand enrollments, roads by themselves will have few consequences.

12. Social change

Rural roads generally bring new values to rural areas, with both positive and negative results. Positive results include increasing national identity and positive government-village relations which create the potential for further local initiative. Yet various manifestations of alienation, such as alcoholism and teen-age rowdyism, indicate some undermining of traditional society. Meanwhile, minority indigenous groups appear to suffer greatly, inasmuch as they lack political and economic power in the society. Women, on the other hand, have found the provision of roads to be liberating, providing them more opportunities, more choice, and freedom from restraints of traditional society.

13. Urbanization, dispersion and migration

The spatial impact of low-volume rural roads is complex and area-specific. Low-volume rural roads strengthen nearby towns as administrative and economic centers, promoting commuting for permanent or short-term work from the surrounding area. In these cases, the direct, initial impact may be to discourage migration. In contrast, rural arterial roads, in sharply reducing the distance between countryside and urban center, may increase migration. Roads also facilitate education and the penetration of urban values into rural areas which may indirectly stimulate migration over the long term.

14. Environment

Rural roads accelerate deforestation as a result of the expansion of agricultural land and the exploitation of timber for firewood, charcoal and building lumber. This leads to increased soil erosion, lowering of the water table, higher incidence of flooding and/or drought, and elimination of wildlife. Roads also intensify land use, which can lead to the shortening of fallow periods and deterioration of soil fertility. New inputs such as fertilizers and pesticides contribute to chemical pollution which may become significant over time. Poor road design has often led to flooding, erosion, timber damage and other environmental damage in the immediate vicinity of roads.

D. Unanswered Questions and Issues

The unanswered questions and issues arising from the literature review that best lend themselves to exploration during short field visits to evaluate rural road projects are mentioned below. Additional questions, issues, and evidence that might be sought to resolve them are cited in Chapter III.

1. Agricultural production and crop composition

   - o If road improvements were made but no measurable changes in agricultural output or crop composition occurred, what are the major constraints?

- Were poor farmers able to boost their production as a result of the road? Did they switch to cash cropping?

- Are changes in agricultural output or crop composition that occur as a result of the road beneficial to low-income people?

2. Technology

   - Do the technologies introduced following the provision of rural roads reach and benefit low-income farmers?

3. Agricultural service institutions

   - To what degree do roads actually increase extension visits to and programs for smaller, poorer farmers?

   - Do roads bring banking, equipment, repair and similar services closer to poor farmers?

4. Non-agricultural business activity

   - How viable are the numerous small retail establishments set up immediately following the construction of the rural road network?

   - Are existing local cottage industries able to survive following the introduction of roads and subsequent greater availability of non-local goods?

   - Do the business activities that arise as a result of the road contribute to basic human needs or do they generate superfluous consumption patterns?

5. Employment

   - While agricultural and non-agricultural industries and commerce do arise via the introduction of a road, are the numbers employed sufficient to offset any employment losses occasioned by the road and to make an impact on rural underemployment?

   - Do roads increase female employment or not?

6. Land values, tenure and use

   - o Does displacement occur, and does it increase the disparity between rich and poor and increase the number of landless in the region?

7. Marketing patterns

   - o What increased marketing activities are taken up by various families according to their place on the income scale?

8. Consumption patterns

   - o Do roads create imbalances between production and consumption levels by stimulating proportionately greater increases in consumption?

9. Health and nutrition

   - o Do the rural poor take advantage of the better access to health facilities made possible by rural roads and expanded transport systems?

   - o Do nutrition levels fall following a road-induced switch from subsistance to commercial farming, and for whom?

10. Education

    - o Do roads improve access to education? For whom and in what way?

11. Community and family structure

    - o Do rural roads strengthen or weaken family and community structure?

12. Values

    - o Do traditional values impede or facilitate the predicted impacts of rural roads, especially on the levels of agricultural production, crop composition and consumption of goods and services?

13. Women

- o Roads tend to liberate women from traditional values and activities. Do complementary programs accompanying the road projects reinforce this trend or conflict with it?
- o Following road introduction, are women vendors displaced by large-scale merchants or do they take advantage of transport to expand their market areas?

14. Migration

- o Does the introduction of low-volume rural roads retard or encourage migration to urban areas, and by whom?

15. Environment

- o Does the impact of the development unleased by the introduction of rural roads inevitably lead to deterioration of farmland fertility, length of the fallow cycle, and the size of the forest and swamp area?

E. Implications

Some of the broad implications of the above impacts, and impact issues for planning factors such as institutional setting, road selection criteria, technical design issues, choice of construction technology, maintenance of roads, etc. are:

- -- the development of rural road projects should be based as much upon social and environmental as upon economic factors;
- -- the target group that a rural road project is to assist should be defined and understood in social, environmental and economic terms;
- -- achieving the desired impact(s) of a rural road project is likely to depend as much upon complementary programs to maximize benefits and minimize negative impact upon the target group as upon the direct results of the road project itself;

-- participation of the target group helps resolve many social and economic issues involved in rural road projects and helps maximize the desired impacts of projects on the target group;

-- adequate baseline information and longitudinal studies are required to fairly assess the specific impacts of rural road projects because such impacts take shape over relatively long time periods.

I. INTRODUCTION

A. Objectives and Methodology of the Study

The objective of this study is to assess the literature on socio-economic and environmental impacts of low-volume rural roads in developing countries, in order to identify those issues which are unresolved and which require further examination and evaluation by AID and other development agencies.

By design the study has been restricted to an assessment of the social, economic and environmental impacts of rural roads. Engineering, administrative, and political considerations, except in so far as they impinge on the socio-economic and environmental outcomes, are not directly addressed.

Dissatisfaction with traditional transport investment (highways, railroads, and other high volume systems) has prompted much discussion and recent implementation of alternative (yet complementary) investment in low-volume rural roads. There exists a large and growing body of theoretical and methodological literature, especially project feasibility studies, but relatively little has been written concerning actual project results. Documentation and analysis of many impacts of rural roads is random, variable in quality and reliability, and often preliminary. This study reviews and synthesizes the available evidence. Part I

serves as an introduction, summarizing examined impact studies in terms of approaches and research methodology used. Part II suggests specific impact categories and presents and analyzes evidence from the literature. Part III summarizes the major areas of agreement and disagreement in the literature, and identifies some implications for AID planners and evaluators.

In undertaking this study, we have reviewed as many evaluation studies as could be located, as well as pertinent works in appraisal methods or more general approaches to road projects. A bibliography and list of institutions and individuals contacted are provided in the appendix.

B. Context of the Study

1. Historical context

Although a history of roads and attitudes towards them is beyond the scope of this paper, a brief attempt is made below to place this study in historical context.

In the late 1950's and early 1960's, international aid agencies took a broad and uncritical view of the impact of roads on economic development. This was apparently based on the pioneer experience of the U.S. and other developed countries, where the importance of the expanding transport network in lowering transport costs and in raising the farmgate prices of farm products was of immense importance.

Examples of this view applied to developing countries can be seen in the statements below:

> "Largely because of the condition of the road, these districts [Chieng Kham, Pong, Therng and Chiengkhawng, Thailand] are much less developed than the rest of the province." [1]
>
> "It has sufficed only the briefest contact with the road to dissolve the tradition of centuries that made for inertia, isolation, and detached contemplation....The whole country is united by this living corridor. Products hitherto deemed unsalable find purchasers. A new sense of human dignity comes from this conquest of nature which is shared alike by those who build and those who use the roads. Egalitarian sentiments flourish." [2]
>
> "...the preparation of a viable base for a modern industrial structure requires that quite revolutionary changes be brought about in two nonindustrial sectors: agriculture and social overhead capital, most notably in transport." [3]

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[1] Michael Moerman, Agricultural Changes and Peasant Choice in a Thai Village, (Berkeley: University of California Press, 1968), p. 6.

[2] Virginia Thompson, French Indo-China, (New York: MacMillan Co., 1937), p. 213.

[3] Walt Rostow, Stages of Economic Growth, (Cambridge; Cambridge University Press, 1960), p. 55.

> "...the one sure generalization that can be made about the underdeveloped countries is that investment in transport and communications is a vital factor."[1]

The reasoning behind these ideas went back to Adam Smith: improved transportation extended the market (giving access to more raw materials and providing more potential consumers), making possible an increased division of labor, which in turn increased productivity. In its crudest but strongest form, "Where roads go, progress goes."

This concept encouraged international aid agencies to finance major transport projects with the expectation that they would open up a region, stimulating economic development and improved social conditions. In the early 1960s, AID prepared case studies of the effects of transport on economic development which imputed a central role to transport. Other studies blamed lack of transport for the failure to exploit high-yielding crops in two countries.[2]

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[1]E. K. Hawkins, Road and Road Transport in an Underdeveloped Country, (London: Colonial Office, 1962), p. 26.

[2]Richard L. Braida, et. al., "The Role of AID in the Development of Sahel Transportation Infrastructure," (Draft) (Washington: U.S. Department of Transportation, Office of International Programs, 1978).

However, the emphasis was on main roads with little or no attention paid to low-volume roads, which were further handicapped by lack of political appeal or "show" value. In at least one case, funds which had been allocated for feeder roads were transferred to main highways due to opposition of government ministries.[1]

In the mid-1960's, more careful analyses showed the effects of roads to be disappointing.[2] Consequently, more stringent appraisal methods were utilized, including road user savings and calculation of internal rates of return.[3] At the same time, however, there was a change in emphasis from major roads to feeder roads as part of a more general change in focus from national economic development towards rural development. This had been brought about by increasing pessimism over population trends, urbanization and, more specifically, little evidence of beneficial side effects of inter-city road construction.[4] These two trends, appraisals utilizing road user savings and a switch in emphasis to rural roads, were brought about by a sense of dissatisfaction with

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[1]Herman G. van der Tak and Jan de Weille, Reappraisal of a Road Project in Iran, World Bank Staff Occasional Papers, no. 7 (Baltimore: The Johns Hopkins University Press, 1969).

[2]Ibid.

[3]World Bank report on selected highway projects.

[4]Chris Edwards, "Some Problems of Evaluating Investments in Rural Transport", in Transport Planning in the Developing Countries (London: Planning and Transport Research and Computation, 1978).

the recognized impact of previous highway projects in developing countries. The trends, however, were contradictory because road user savings do not fully reflect "development" and therefore are an inadequate means of measuring the impact of rural road projects in developing countries.

In the 1970's this contradiction and the failure of traditional road projects to benefit the rural poor, who were increasingly becoming the explicit target beneficiary, became more apparent. Non-transport constraints on development began to be seen as being more important than had previously been recognized as well.[1] As a result, the emphasis in this decade has been to consider roads as one aspect of comprehensive, or "integrated", rural development projects.[2] It was thought, and recent experience confirms, that rural road projects are most successful where there is an attempt at integrated or complementary development, with the road constituting but one of several essential services. These may include

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[1] V.F. Corbett, "The Implementation of a Socio-economic Priority Ranking Scheme in the Evaluation of Ethiopian Rural Road Programmes," in Planning, Transport Planning and Highway Design in Developing Countries (London: Planning and Transport Research and Computation, 1977).

[2] For example, within the World Bank, 80% of lending for rural roads is now part of agricultural or integrated rural development projects, where roads serve a particular complementary function.

market reform (including price guarantees, marketing information, provision of storage facilities, and organization of cooperatives), land reform, the provision of agricultural inputs and credits, and irrigation, extension, education, and health services. It has been pointed out that even this more integrated approach tends to suffer from simplification. Specifically, there is a tendency by some to replace the "roads equal development" equation with "roads plus agricultural extension equals development."

To overcome this and other oversimplified equations, appraisal and evaluation methods are beginning to become broader once more, eschewing the narrow focus on road user savings of the 1960's, but at the same time being more systematic and sophisticated than was the broad, optimistic focus of the 1950's. This has been accelerated by attempts to take into account social and distributional consequences, such as the spread of diseases, ethnic disintegration or intra- and inter-national exploitation.[1] Since

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[1]For specific discussions see: on spread of diseases, Hughes and Hunter in M. Taghi Farvar and John P. Milton, eds., The Careless Technology, (Garden City, NY: The Natural History Press, 1969); on ethnic disintegration, see Shelton Davis, Victims of the Miracle, (Cambridge: Cambridge University Press, 1977); and on intra- and inter-national exploitation, see Piers Blaikie et al., "The Relation of Transport Planning to Rural Development: The Implications of Road Construction in Nepal," in Planning, Transport Planning and Highway Design in Developing Countries, (London: Planning and Transport Research and Computation, 1977).

the mid-1970's income disparities between classes or groups showed little sign of closing, and there has been great concern about the distribution of benefits from road projects.[1] Transport economists who have focused on savings to present users in industrialized countries have had to rethink appraisal techniques so as to emphasize generated traffic, producers surplus benefits, and analyses of the whole socio-economic structure of a rural area.[2] British researchers, especially, have emphasized the need for regional socio-economic studies to identify constraints on development, both within and without the transport sector.[3]

These changes in approach to road projects have also meant a greater emphasis on field evaluations of completed road projects (ex-post) at the expense of theoretical appraisal methods (ex-ante). However, the first attempt at a survey of road evaluations found barely a dozen available accounts.[4] Several major international assistance agencies have recently completed or are undertaking

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[1]See Edwards, "Evaluating Investments in Rural Transport," and Blaikie, et al., "Road Construction in Nepal."

[2]Corbett, "Ethiopian Rural Roads Programmes."

[3]Blaikie, et al., "Road Construction in Nepal," and Edwards, "Evaluating Investments in Rural Transport."

[4]George W. Wilson et al., The Impact of Highway Investment on Development. (Washington: The Brookings Institution, 1966).

in-depth evaluations of road impact in developing countries utilizing baseline studies, so that it is only in the last few years that evaluations have begun to feed back into appraisal approaches.[1]

2. Working definitions

Every road differs in its functions and characteristics. As a result, the attempt to categorize roads is bound to be somewhat arbitrary. Yet we can think of a continuum of land transport routes, ranging from footpaths and ox-trails to farm-to-market roads, village access roads, secondary roads, and arterial highways. Surprisingly, there is substantial agreement in the literature concerning road definition by function although not by name. Generally such agreement consists of a three-fold classification system for rural roads, correspondence between which is evidenced in table 1.

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[1] See Brigitta Mitchell and Xavier Rakotonirina, "The Impact of the Andapa-Sambava Road," (The World Bank and the Democratic Republic of Madagascar, 1977) and Adhemar Byl, "The World Bank Group and Rural Roads" in Planning, Transport Planning and Highway Design in Developing Countries (London: Planning and Transport Research and Computation, 1977).

Table 1 : Three Suggested Classification Systems for Rural Roads

AID[1]	World Bank[2]	Cornwell[3]
Rural arterials/ connectors	Class I	Secondary roads
(Generally part of integrated network; connect centers of substantial population and economic activity)	(Major roads which also fulfill a rural access function)	(Distributor road which serves as an important link in the transport network, carrying a significant proportion of through traffic)
Rural collectors/ feeders	Class II	Local distributor roads
(Serve minor population or economic centers of activity, channel local traffic into the arterial system; no through traffic)	(Feeder roads connecting villages and small markets with larger regional centers or major transport arteries or both)	(Perform both local and through transit functions)
Rural local roads	Class III	Feeder/collector roads
(Serve singular or small groupings of farms, residences, or businesses)	(Farm-to-market roads)	(Give access to the bordering rural area but do not generally serve through traffic)

[1] J.P. Zedalis, "Classification of Rural Roads." (Washington: USAID, 1979), p. 2.

[2] Mitchell, "Andapa-Sambava Road."

[3] P.R. Cornwell, "Some Aspects of the Measurement of the Impact of Feeder Roads in West Africa" in Transport Planning in Developing Countries (London: Planning and Transport Research and Computation, 1978).

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The major difference between the evaluation of highways and that of rural or development roads is that, in the analysis of the former, emphasis is placed on transport economics (traffic generated, user costs savings, etc.) while broader economic and social considerations have been traditionally of secondary interest. The reverse is usually true in the analysis of rural roads, where the impact is much more diffuse, with induced changes in agricultural and non-agricultural production, health, education and other services, and social and environmental effects. This difference between a primarily economic impact and a primarily social impact is accentuated if the low-volume road is in a developing country which has only a rudimentary road network.[1]

Our intent has been to concentrate on low-volume rural roads, corresponding to the second and third categories summarized above. However, because of the necessary artificiality of any categorization of roads, the imprecision of many studies as to the traffic volume and function of the road, and the comparative thinness of the literature, studies of higher volume rural roads corresponding to the AID

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[1] In Mexico, "social roads" are those rural roads whose consequences are primarily social and political rather than economic (as with rural penetration roads). See Henry M. Steiner, "Mexican Social Roads," International Development Review, VIII 3 (1966), p. 21.

rural arterial category have also been included in this study. Including these roads, which provide rural distributor and farm-to-market functions, provides valuable hints as to the types of issues and questions that should be explored, and data and conclusions that could be attributable to low-volume roads. Reviewing this broader range of types of roads, for example, throws more light on the issue of whether the impacts of various land transport routes differ more in degree than in kind. As described below in Part II, different types of roads, serving different primary functions, may have opposite impacts on some factors such as migration.

C. Evaluative Approaches and Methodologies

1. Evaluative approaches examined

This section reviews, in general terms, the various approaches utilized in evaluation of road projects. These are not mutually exclusive, and are here distinguished from assessment methods (e.g. road user savings, producer surplus).

a. Site inspections

Probably the most frequent approach to the evaluation of road projects is a post-project visual inspection, including

ad hoc conversations with officials or opportunity samples.[1] This method has the advantages of being cheap, not requiring elaborate equipment and providing results in a short period of time. Its disadvantage is that the quality and type of information gathered depends greatly on the investigators and their knowledge of the area and which interviewees happen to be available, making systematic comparisons between projects difficult.

b. Questionnaire surveys

When outside consultants are asked to carry out evaluation studies, they tend to be a bit more systematic and to utilize some form of questionnaire.[2] These surveys can be carried out rather quickly, are quantifiable, replicable and comparable to other studies,

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[1] e.g. Hoskins - Western - Sonderegger, Inc. "Final Report: Labor Intensive Road Program, Small Farmer Development Project, Haiti", 1978; Daniel Shaughnessy et al., "Special Evaluation of the USAID CARE Food for Relief Work Program" (Washington: USAID, 1978); and ROCAP, "Economic Evaluation of Three Integration Roads Financed with ROCAP/CABEI Funds" (A ROCAP Report, July 20, 1977).

[2] For example, see James A.S. Blair, "The Regional Impact of a New Highway in Sierra Leone," African Environment III.; Richard A. Ellis, et al., "Liberia Rural Roads Study, Vol. II Socio-Economic Baseline Report" (Washington: Checchi and Co., 1975); Hughes in Edwin T. Haefele, ed., Transport and National Goals, (Washington: The Brookings Institution, 1969); USAID/Philippines Provincial Development, "Rural Roads Evaluation Project" (Philippines: USAID, 1978).

and are amenable to a variety of statistical treatments. Questionnaires can be administered by local people after brief training, thereby overcoming language problems. They can be administered to households, village officials, administrators, transporters, traders, and entrepreneurs. Samples can be chosen to represent income categories, occupation, education, spatial or time relationships to roads, socio-economic or ethnic groups, or any of numerous other variables which might be related to the impact of roads. Interview forms can probe demographics, occupation, land tenure, household income (in cash and in kind), agricultural production, marketing patterns, travel and migration, remittances from migrants, social participation, service utilization (education, health, agricultural extension, credit), agricultural innovation (use of fertilizers, high-yield variety seeds), household assets, attitudes, and perceptions. Framing questions to maximize recall or repeated administration of questionnaries can gauge changes over time in income, land tenure, travel patterns, service utilization, production and marketing patterns, and household assets. Forms may be one page long, requiring three or four minutes to answer, or multi-page, requiring 30-40 minutes or more.

The chief disadvantages of questionnaire surveys are the superficiality and poor reliability of data, especially if the investigators are not familiar with the area, or if interviewers are government representatives or seen as intimidating by those being interviewed. For example, one Berger study noted that in Thailand villagers were often frightened by the interview, which was administered by government representatives in an area of active terrorist activity.[1] They were especially hesitant on questions dealing with crops planted and sold, labor, and other economic subjects. The authors maintain that this had little effect on the substantive results of the survey, but any one familiar with the area must take this with a grain of salt.

It is imperative that questionnaires be modified for each area surveyed, that coding begin in the field so as to turn up problem areas as soon as possible, that they be administered by persons who will enjoy good rapport with respondents, and that they be interpreted and administered by those with knowledge of the area.

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[1] Louis Berger International, "Study of Transport Investment and Impact on Distribution of Income in Remote Areas, Phase I Final Report," E. Orange, N.J.: Louis Berger, International, 1979), p. 5-13.

c. Analysis of production/consumption patterns

To determine the mechanisms by which a road induces development, Shoaib attempted to isolate the impact of a road from that of other factors which influence development. He used as a point of departure the internal rate of return, paying particular attention to the traffic composition. Next, he studied the region served by the road (not only the region traversed but its ramifications or network effects). Finally, he studied particular crops, economic activities, and rural regions in order to trace the effect of reductions in transport costs through the economic system, at the level of the consumption and production units, taking into account detailed production processes, prices, and demand conditions. The questions he asked were: (1) What are the characteristics of the region and how is development affecting it? (2) What factors influence this development? (3) What was the influence of roads relative to other factors? (4) What are the constraints to development and specifically, to full utilization of roads? (5) What alternative action and investment programs, including roads, would have resulted in a higher development impact?[1]

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[1] World Bank report on selected highway projects.

This type of evaluative approach is detailed, in-depth, and insightful, yet it is also time-consuming and costly. The disadvantages could be overcome to some extent by carrying out such evaluations for regions rather than for individual roads.

d. Political economic analysis (power relationships)

An extension of the previous approach is to consider the political and economic context, specifically national power relationships, or as Davis puts it, "looking at roads from the top down instead of the bottom up."[1] Davis has done this in his study on Brazil, pointing out the role of roads as part of a larger exploitative pattern in the destruction of the Amazon forest, soils, and indigenous populations. Rather than internal rates of return, he focused on the larger effects upon the environment and ethnic groups.

Blaikie, et al., analyzed the effects of three rural arterials in west central Nepal from this broad point of view, concluding

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[1] Davis, Victims, 1977.

that the roads had marginal positive effect on production due to constraints largely external to, or beyond the control of, the local economy.[1] These constraints included population pressure, ecological decline, primitive agricultural technology combined with inadequate capital surplus for investment in new technology, commercial domination by India, and the generally exploitative nature of the Nepali political economy. In fact, gains from the roads were generally skewed to Indian manufacturers and the relatively closed commercial class.

Edwards utilized a similar analytical approach in Bangladesh, concluding pessimistically that rural roads have had only a small positive impact on development. For the most part, provision of roads has contributed to the widening of income disparities and the concentration of capital. In fact, the net effect on the employment and income of the poorest is likely to be deleterious. He notes that road projects will continue to be popular not because of economic reasons but because government officials desire greater access to all parts of the country; donors like the "show" effects, the ease of administering such programs, and the ties they forge with the donor country; landed farmers benefit from access

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[1] Blaikie, et al., "Road Construction in Nepal."

to government credit, supplies and grants, and increases in land rents; and the military and police gain greater mobility for security and law enforcement action.[1]

e. Comparison of ex-ante and ex-post observation

Ideally, in order to most accurately establish the nature and degree of project impacts, data on the target area should be acquired prior and subsequent to project implementation, and a comparison made. Baseline data provides the benchmark from which the changes associated with projects can be measured, enabling evaluation to go beyond general statements about gross impacts. However, such studies are costly and it requires anticipation and precise planning to execute the baseline survey before the project gets underway. The mere fact of requiring two studies many years apart is perhaps a sufficient obstacle in itself.

The best example of this approach developed following the discovery by one evaluator of a baseline study undertaken by another research team. This occurred in Madagascar, where a French team, using an extensive questionnaire survey, carried out a detailed twelve-month study of the Andapa Basin in 1964-65. Five years

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[1]Edwards, "Evaluating Investments in Rural Transport."

later, the World Bank financed an unrelated rural roads project in the area. Quite by accident, a World Bank staff member discovered the existence of the original survey data, leading to a five-month re-study in 1975.[1] In addition to measuring standard outputs such as road user savings and producer surplus, the Bank team also measured socio-economic impacts such as the degree to which transport savings were passed on to producers and consumers, changes in income and income distribution, and changes in consumption patterns. The study notes that the affected populations' perceptions are often more important than the scientists' measurements in answering questions such as, "What is a farmer's threshold of risk aversion?" and, "At what point will changes in transport affect behavior?" The study also notes the importance of involving local investigators and institutions to ensure follow-up evaluations.

This restudy approaches the ideal of road impact studies, having a well-defined geographic area in which no roads existed previous to the project, excellent baseline data, and a relatively broad analysis of the regional economy. In regard to the latter, and in support of the conclusions of Davis, Blaikie, et al., and Edwards, the study argues convincingly that one of the least recognized reasons for misleading project return estimates is inadequate definition of the ex-ante situation, especially of

[1] Mitchell, "Andapa-Sambava Road."

existing system constraints. Strengthening the ex-ante/ex-post evaluation approach would be the use of a control area to suggest what would have happened had the road never been built. Influences external to the road could more likely be isolated.

Before	road	no road (control area)
After	road	no road (control area)

Of course, no two areas are exactly alike. Given this methodological difficulty, in practice the best solution may be to compare sites with different degrees of access (to roads) over time, carefully taking into account the demographic, social, and economic settings.[1]

f. Anthropological and economic fieldwork

This approach, participant-observation coupled with intensive economic analysis, is particularly effective[2] and could be

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[1] Ellis et al., "Liberia Rural Roads."

[2] As contrasted to surveying, for example, it is easier to build trust with key informants over time and to repeat observations until an action or impact is clearly understood. The methods that appear most likely to provide the needed data during field visits of four to six weeks include surveys, use of key informants, and anthropological and economic fieldwork drawing upon existing data, observation and interviews. In essence, this would be a combination of the survey and anthropological and economic fieldwork categories above with both compressed into the short time period available.

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expected to yield the most reliable data. Insofar as we could ascertain, however, in regard to rural roads, it has never been fully carried out. It has been best approximated in studies done by Mitchell in the World Bank Andapa Study, Blair in the Sierra Leone study, and Brokensha in the Kenya draft.[1]

A World Bank study of rural development in Yucatan concentrated in particular on the road's impact on women. The study had the benefit of a previous classic study of the same village by Redfield and Villa Rojas in the 1930's. The study found that the road provided not an escape through migration but an opportunity for enlarging women's potential through introduction of new ideas, education, medical care and economic alternatives to maize cultivation. In particular, it was noted that the road's impacts on sex roles, values and family life, as women married later, had fewer children and carried on more activities outside the home.

This study also suggests a means of overcoming the major disadvantage of anthropological-economic fieldwork for project evaluations, namely, the time required for each study. This remedy would be to use anthropologists

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[1]See Mitchell, "Andapa-Sambava Road;" Blair, "Impact of a New Highway in Sierra Leone," 1978; David Brokensha, et al., "Kenya Draft (Washington: Devres, 1979).

who have already done fieldwork in the region as part of a project evaluation team.[1]

2. Impact assessment criteria

Two trends are in evidence today with respect to the introduction of rural roads into an area and consideration of their impact. First, as mentioned earlier, increasing recognition is being given to the non-economic effects of rural roads. Second, the provision of rural roads has increasingly become but one component of comprehensive rural development projects. The combined result of those trends has been an attempt in recent years to go beyond the traditional methodologies of appraisal and evaluation in order to adequately assess road impacts.

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[1]Finding anthropologists and other social scientists with such experience is not always easy, but several avenues are available for doing so. Perhaps the most fruitful is to use the grapevine among major international and national assistance institutions, and foundations to locate a social scientist with the requisite experience Another is to check with the American Society of Anthropologists (which has a consulting roster), other professional associations and various other non-governmental organizations. A third avenue is to seek the needed experience from private firms such as the Institute for Development Anthropology, Social Systems Analysts, etc. Another source of such experience, of course, is the universities, especially if they tend to have a regional focus in their international development work and experience.

The two basic quantitative methods of measuring road benefits--road user savings and producer surplus, and their advantages and disadvantages--are briefly summarized below.

a. Road user savings

Road user savings is a quantifiable measure used by many institutions, including the World Bank, and endorsed by the OECD for roads in areas where current and projected economic activity is substantial. Road user savings focuses on traffic volume and cost of transport services, and is generally more appropriate for higher volume highways. Benefits are estimated in terms of the difference in operating costs between that of normal traffic (i.e., traffic that would occur irrespective of road improvements) on the new road and that on an alternative road or the road before improvement, whichever is lower. To this is added the benefit associated with generated traffic (i.e., the additional traffic induced by the investment). The value of time savings of drivers and passengers may or may not be included. Increased production as a result of the road is not counted, inasmuch as in theory it is represented by the benefits associated with generated traffic.[1]

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[1]See J.L. Hine, "The Appraisal of Rural 'Feeder' Roads in Developing Countries." Transport Planning in Developing Countries (London: Planning and Transport Research and Computation, 1975); Mitchell, "Andapa-Sambava Road"; OECD, Conference on Rural Road Transport Planning in Developing Countries, Paris, 15-16 Dec., 1977; and A.A. Walters, The Economics of Road Users Charges, (Baltimore, Johns Hopkins University Press, 1968).

One variation is to make a further distinction between generated traffic and development traffic (i.e., traffic resulting exclusively from bringing new land into production, or new enterprises) although this seems very difficult to estimate.[1]

Both theoretical and field studies suggest that there may be disproportionally large indirect benefits from roads. Effects such as increases in interregional trade may allow greater economies of scale. Increases in labor catchment area may permit more efficient utilization of labor resources, and quasi-Keynesian multiplier effects exist, meaning that user savings evaluations often underestimate potential increases in national income or true social benefits.[2]

Low-volume roads in developing countries present some special problems with user savings appraisals or evaluations. The method unrealistically assumes an economy with perfect competition and full utilization of resources (land, capital, full employment), where everyone is acting rationally.[3] In addition, the operating

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[1] ROCAP, "Economic Evaluation of Three Roads."

[2] K.M. Gwilliam, "The Indirect Effects of Highway Investment." Regional Studies, 1970.

[3] A.J. Plumbe, "Implication of Feeder Road Usage by the Farming Community of South-East Thailand," Transport Planning in Developing Countries (London: Planning and Transport Research and Computation, 1978).

costs on dirt roads are difficult to estimate, especially with respect to the value of time savings and different loading, unloading, and distribution costs as a result of changes in mode of transport.[1] The World Bank has adapted the road user savings method to include three additional considerations: (1) the distribution of benefits (to whom do cost savings accrue and are savings to producers sufficient to stimulate increased production?); (2) complementary investments (are these sufficient to overcome non-transport constraints, do producers have the required resources, attitudes and risk preferences to respond?); and, (3) consistency with regional development plans.

b. Producer surplus

This method, also used by the World Bank and endorsed by the OECD, is a quantifiable measure for road effects in areas of low levels of economic activity, and focuses on the development effects--specifically, changes in volume and value of agricultural production--rather than on traffic volume and cost of transport services. Project benefits are measured directly in terms of the value of net output and income (rather than indirectly in terms of user savings). To apply this method it is necessary to understand

[1] OECD, 1977 Conference.

the mechanics through which transport and production interact and to identify the flow and pricing of production inputs and outputs (including transport costs and prices). Higher agricultural prices and lower input costs relative to the magnitude of transport savings will affect the farmer's production function.[1]

c. Problems of the two quantitative approaches

Both user savings and producer surplus approaches assume that farming behavior will express itself directly through the transport price mechanism. In the real world there are many complicating and overriding factors. In Central America, for example, disputes between neighboring states, political instability, economic recession and depressed prices on the world banana market led to negative results in terms of user savings and producer surplus evaluations. Price changes or demand shifts (e.g. coffee prices in Honduras and Ethiopia) very often had impacts on area development which overweighed those of roads.

Other cases which argue for broader evaluation methods are instances in Colombia and Iran where transport savings were not passed on to producers because of monopolies in the transport and marketing sectors, or in Brazil and elsewhere where landowners benefited but

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[1] Carnemark, Curt, Biderman, Jaime, and Bovet, David, "The Economic Analysis of Rural Roads Projects." World Bank Staff Working Paper No. 241. (Washington: IBRD, 1976).

tenants did not.[1] In Botswana, the bottlenecks were in the livestock industry where primitive production techniques, deficiencies in the marketing system and lack of agricultural credit resulted in negligible road impact.[2]

Both approaches have further individual shortcomings. Given pure cash crop production (i.e., no consumption of home-grown crops), both user savings and producer surplus methods theoretically will give identical results. However, where there is self-consumption of crops, the user savings will fail to account for this unrecorded part of the total road benefits.

On the other hand, the producers surplus fails to account for passenger benefits other than farmers' trips to market, whereas the user savings method takes into account commuting and travelling for pleasure. This is often an important factor: in Ghana, for example, passengers accounted for 83% (by weight) of all goods and people travelling along feeder roads.[3] On a feeder road in

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[1] Carnemark, et al., "Economic Analysis," and van der Tak and de Weille, Road Project in Iran.

[2] Carnemark et al., "Economic Analysis."

[3] Riverson and Afile in Plumbe, "Feeder Road Usage."

Thailand only about a third of all vehicle journeys were connected with agricultural production. Shopping, recreation and visiting friends were also important motives for using the road.[1]

The complex set of interrelationships which exist among production and transport factors are not brought out by either user savings or producer surplus methods which are only interested in the bottom line. In arguing for more research on identifying the basic mechanisms of these relationships, one author suggests that it might be better to focus on the qualitative changes rather than to attempt to quantify project inputs and outputs.[2] In any case, aspects other than the level of production, income, or traffic are increasingly recognized as being as or more important, in spite of our difficulty in quantifying them. Such aspects include health, education, previously unutilized resources brought into use and national integration, among others. The next section reports on the findings of a diverse set of project evaluations concerning both quantitative and qualitative socio-economic and environmental impacts.

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[1] Plumbe, "Feeder Road Usage."

[2] Ibid.

II. IMPACT CATEGORIES

Some of the problems in assessing the impact of roads and attributing causality have been noted above. However, there remains a pragmatic need to evaluate these projects which makes it necessary to think in terms of specific impacts associated with the construction of specific roads. In the older literature,[1] these associations are thought to be causal, but there is currently little enthusiasm for this point of view in light of the great variations identified in response to a road, and the clear importance of many other factors and the way in which all of these interact. Thus, the categories of impacts discussed in this chapter cannot be attributed solely to road development in an area. Rather, roads must be seen as a significant and occasionally primary factor associated with such impacts.

The materials that follow are organized under "impact" headings and subheadings. This is a structural artifice for presenting the findings as cogently as possible. Often, an impact is described under more than one heading, and results of studies are commonly broken down among several impact categories.

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[1] See, for example, Lionel Odier, The Economic Benefits of Road Construction and Improvements, (Paris: UN, 1967); India, Ministry of Transport and Communications, "Economic Benefits of Ramnad-Mandapam Road," India: Department of Transport, 1961.

A. Production

1. Agricultural production

Nearly all feasibility studies stress the potential production benefits of rural roads. Evaluations of completed roads, however, are less optimistic about the magnitude of such benefits. There is an historical and locational relationship between agricultural development and transport development. Areas close to roads (and markets) are more likely to demonstrate agricultural development than areas further away. Much is known about what roads can do, but little is known about what roads will do without examining production and marketing constraints.

a. Production levels

It is generally recognized that one major impact of rural road construction may be an increase in agricultural productivity. The bringing of new land into cultivation, more intensive cropping and the greater ease of obtaining inputs all contribute to the increased level of production. One interesting issue in this regard is the extent of the zone of influence of the road project; that is, what is the correlation between distance from the road and level of productivity? The following discussion identifies a number of country experiences which have seen marked production rises, as well as pointing to several where increases

have not resulted for one reason or another.

Spatial expansion or the intensification of land use caused by roads leads to production increases in subsistence and, more importantly, in market crops. One study examined stated that the effect of transport on output levels was dependent upon the scope and potential for increased agricultural productivity within a region (i.e., on land quality, area previously uncultivated or undercultivated, responsiveness to production inputs, etc.) as well as on the elasticity of the factors of production. Thailand was identified as a country with appropriate conditions for both increased productivity per land unit and more extensive cultivation.[1] (A different evaluation of the Thai example, as well as counter examples from Nepal, Ethiopia, Honduras and Yugoslavia, will be examined at the end of this section.) In Thailand, the Friendship Highway network greatly increased agricultural production by opening new areas to cultivation and introducing new crops. It enabled

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[1] L. Sychrava, "Some Thoughts on Feasibility Studies, Occasioned by the Appraisal of Road Projects in Thailand", Journal of Transport Economics and Policy, II. 3, 1968, p. 343.

farmers in the provinces of Saraburi and Korat to deliver fresh produce directly to the large demand areas as well as to more easily obtain inputs. During a two-year period crop production increased 1.64 times -- rice was the single crop which increased only marginally -- and poultry production rose steadily.[1]

To illustrate road-induced production benefits, DeBeer reports that an increase of 114 percent in road mileage in one district of Uganda resulted in a 400 percent increase in cotton production, and a 280 percent increase in cotton production. This resulted in a 700 percent increase in cotton production. This resulted in a per capita increase of four and a half times for cotton output.[2] Another Ugandan evaluation of feeder roads showed that:

	Terego	Madi	Jonam
increased road mileage (1946-56)	0	200%	400%
increased cotton acreage per capita (1946-56)	-38%	364%	380%
increased income from cotton (1948-56)	230%	373%	525%

Even taking into account increased cotton prices, increases in acreage and income were considerable as a result of the

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[1] Wisit Wasiraksa, "Economic Effects of the Friendship Highway, Thesis No. 41, (Bangkok: SEATO, Graduate School of Engineering, 1963).

[2] A.R. DeBeer, "The Economic Justification of Roads in Developing Countries", Road International, 48, 1963.

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road.[1]

Spatial considerations of road impacts also suggest there is a direct correlation between distance from the road and level of agricultural productivity. A Brookings study contends that surfaced roads can be expected to influence surrounding land to the depth of at least one mile from the road on either side (a ten-mile stretch, ten square miles on each side means 30 square miles opened up to intensive cultivation, 12,800 acres). Theoretically, if an acre yields 1,000 lbs. of wheat before intensive cultivation, 20 percent (2.5 million lbs. for the ten-mile road) of which is marketed, the opening of the road should double output, and increase the marketable surplus by 10.3 million pounds.[2] Actual case studies seldom reach this ideal.

A study of a 20-mile feeder road connecting to a national highway in India examined villages at varying distances from the highway before and after construction, and found the following

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[1]Smith in Wilson et al., Highway Investment.

[2]Wilfred Owen, Distance and Development (Washington, Brookings, 1968).

increases in cultivated areas:

distance from highway (miles)	cultivated areas (acres) 1954-5	1958-9	percentage increase
0-1	2500	3000	20
1-2	3600	3700	3
2-3	5800	6100	5
3-4	3700	3800	3
4-5	1200	1900	58

These figures reflect the influence of the road (20 percent increase in the first section) and availability of new resources (a 58 percent increase in the last section, where less land has traditionally been under cultivation).[1]

These studies, plus numerous others, indicate that roads induce an increase in land under cultivation and a real increase in agricultural production (net growth not due to relocation). But it is also important to realize that other factors enter the picture, such as in Bolivia where a ten-fold increase in sugar cane output between 1954 and 1962, and the tripling of rice production from 1958 to 1963, was partly a result of the exploitation of virgin soil. In ten more years, to maintain current yields,

[1] Government of India, Ramnad-Mandapam Road.

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it is estimated that fertilizer inputs required to maintain current sugar yields ten years from now, will equal 20 percent of the crop value. In North Borneo and Uganda, population pressure induced the taking up of new lands, whether roads existed or not. But in Bolivia new lands could not be settled without roads. The availability of easily exploitable natural resources, especially timber, accounted for increased production in Thailand and Peru, and the lack of such resources accounted for less generated traffic in Guatemala.[1]

The World Bank conducted a study of road projects in Northeast Africa, Southeast Asia, Central America and Europe which found that the indigenous productive structure was a major obstacle to development, and the roads had little effect in changing this structure or introducing new crops. An exception was in Northeast Africa where 10,000 tons a year of oilseeds, grass and pulses were produced, about half of which seems to have been produced with previously unused resources.[2]

Analyses of changes in agricultural production are not always in agreement even for the same region and road project. In Nepal, an early study on a road built in 1968 found that wheat introduced two years before the road has replaced mustard, the traditional

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[1] See Wilson, Highway Investment.

[2] A World Bank report on selected highway projects.

crop, five years later, and families in that area consumed two and a half to five times more wheat per capita than other areas. The study estimated that wheat production should increase 18.8 percent annually and maize 1.7 percent, based on the assumption that fertilizers, insecticides, fungicides, agricultural extension and new seed varieties will be available and used as a result of the road. However, price reductions of fertilizers and other items after the highway was opened were quickly taken up by rising import taxes, devaluations and seasonal variations. The primary lasting effect of the road has been a reduction in price differential between Pokhara and lowland terai towns, but they note that population growth erodes most of the advances in production.[1]

Blaikie et al. found later (1977) that these factors plus ecological decline, low productivity due to domination by India and the nature of Nepali political economy have minimized any positive effects of roads on production, agricultural or industrial. In fact, they found that production had declined in some areas: tangerine production decreased due to lack of extension services and ghee production decreased due to lack of grazing areas for buffalo. Small peasant producers have not been able to adopt new

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[1] Mark C.W. Schroeder and Daniel G. Sisler, "Impact of the Sonauli-Pokhara Highway on the Regional Income and Agricultural Production of Pokhara Valley, Nepal." (Ithaca: Cornell International Agricultural Development Bulletin 14, 1971).

technology or new crops, in part because they lacked access to complementary credit or extension services. Thus, the study concluded that the expected positive impacts of roads on production have not resulted.[1]

b. Crop composition

In theory and as a general conclusion from the evaluation literature, we can say that better roads provide easier and cheaper access to market, favoring a shift from the cultivation of crops purely for subsistance, to selling such crops in a market and growing new crops specifically for the market.[2] Roads provide the opportunity to move from subsistence farming into commercial activities with crops requiring greater inputs, but giving higher yields and rates of return to the farmer through commercial sale. They can be integrated with the production of food for personal consumption. The increased availability of production inputs as well as consumer items (i.e., food staples), allows farmers to concentrate on a few crops, specifically, cash crops. Distance from farm to market tends to influence the kinds of crops that are specialized in. The closer to market, the more perishable the crop can be (such as vegetables or fruits).

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[1]Piers Blaikie, et al., The Effects of Roads in West Central Nepal, Part I (A report to ESCOR, Ministry of Overseas Development, 1977).

[2]M. Chisholm, Rural Settlement and Land Use, (London: Hutchinson University Library, 1962).

A shift to commercialized food or cash cropping as a result of roads (and other factors) is seen in numerous evaluation studies. In Thailand, several post-evaluation studies found no changes in rice production, but an increase in vegetable production in areas close to market towns.[1] Rubber and upland crops also increased. An AID evaluation of rural roads in the Philippines found that over a two-year period there was a 40 percent production increase in seven marketable crops, a 62 percent increase in vegetables and a 46 percent increase in fruits. Roads were not the only factor, but they induced visits by extension agents and provided easier and cheaper access to farm inputs.[2]

Distance from the market and ease of utilization affect the impacts which roads have on production. In Liberia, Ellis found that the degree of access to market was inversely correlated with the number of people who farmed, but positively correlated with the percentage who sell some crops.[3] This indicates a shift to wage work, and from subsistence farming to marketable crops. Wennergren and Whitaker found in Bolivia that net return per hectare

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[1]John Hugh Jones, "Economic Benefits from Development Roads in Thailand" (Bangkok, SEATO Graduate School of Engineering, 1964).

[2]USAID/Philippines Provincial Development, "Rural Roads Evaluation Project." (Philippines: USAID, 1978).

[3]Ellis et al., "Liberia Rural Roads."

for each crop and the average return for all crops declined as distance from market increased. Proximity to market reduced transport costs and allowed a shift to more profitable, heavier, transport-intensive crops such as sugar cane. Those farmers closest to the paved road grew sugar cane for which transport costs accounted for up to 65 percent of the market value. As one moved down the feeder road away from the paved highway, bananas become more important because of their higher value per weight and reduced perishability. Furthest from the highway rice was grown almost exclusively. Rice has a higher value per weight (transport costs were only 6 to 12 percent of value) and can be stored for extended periods of time.[1]

The Nepal situation, however, is in contrast to the above findings. Increased agricultural imports, rather than exports, have resulted from the road, no new crops have appeared, and there was a move towards increasing subsistence cultivation due to population pressures which have outweighed any positive development impact. The roads have not touched the central problem of the hill agricultural economy, i.e., the limited cultivation potential of the impact area, and were not accompanied by secondary and tertiary complementary investment.[2]

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[1]E. Boyd Wennergren and Morris D. Whitaker, "Investment in Access Roads and Spontaneous Colonization: Additional Evidence from Bolivia," Land Economics 52, 1976.

[2]Blaikie et al., Roads in Nepal, p.vi.

Roads seem to encourage a shift to some cash crops in some areas, but these often require outside entrepreneurs or complementary inputs. One study suggested that roads tend to have a greater initial production impact where cash crops are grown because food crops, grown by small farmers, have a lower price elasticity than do cash crops. Thus, the more developed the agricultural system, the more significant and the faster response to road provision or improvements within an area.[1] Another theory is that (assuming constant population pressures) the area used for export crops per mile of road is a function of (1) quality of the land, (2) distance from the main commercial center and market, and (3) the standard of the road used.[2]

Berger found in Malaysia, Indonesia and the Philippines that production of subsistence crops, including those of commercial value, was stable; but, the production of cash crops increased either as a result of other development programs or diffusion from neighboring areas.[3] A key determinant in farmer response was price information, and transport helped in this by providing more contacts with traders and middlemen. In Thailand, 30 percent of Thai farmers

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[1]Foreign Economic Development Service, Improving Marketing Systems in Developing Countries (Washington; U.S. Department of Agriculture, 1972).

[2]R.S.P. Bonney, "The Relationships Between Road Building and and Economic and Social Development in Sabah." (Drayton, England: Road Research Lab., 1964), p. 29.

[3]Berger, "Study of Transport Investment."

surveyed had increased the area under rice since the road was built. Tapioca and kenaf production had begun after the road. Twice as many Thais sold produce as had ten years before.

An intensification of cash cropping in Madagascar was found in one study. Prior to the opening of the road, coffee exports were air-freighted and it was not feasible to export rice. Lower transport costs as a result of the road, however, increased coffee exports (yields also increased as a consequence of extension efforts), and rice exports have become important. The 1975 value of production was estimated at 1,480,000 FMG, whereas without the road it is estimated that it would have been 880,000 FMG (self-consumption products were valued at producer prices).[1] In Peru, Drewes found that the amount and variety of cash crops increased, generating exportable surplus and the ability to import greater quantities and more varied goods. But, in addition to the roads, the attitudes and technological abilities of settlers and government policies were important variables.[2]

Hine, on the other hand, found that export cash crops in Sierra

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[1] Mitchell and Rakotonirina, "Andapa-Sambava Road."

[2] Drewes in Wilson et al., Highway Investment.

Leone are unlikely to be affected by feeder roads because of the high initial costs in establishing packaging and processing plants and the large transport costs in getting crops to world markets. He found the opposite in the case of dairy products, green vegetables and fruits for the domestic market, where there is a premium on freshness, and where storage is difficult. He suggests that in some cases an alternative to all-weather roads might be the better handling and packaging of commodities.[1] Hughes, as well, found no development of cash crops in Malaysia, but offers little explanation.[2]

c. New technology and inputs

Transport development, by increasing access to markets and the outside also aids in the exposure to and delivery of agricultural inputs such as fertilizer, improved seed, extension visits and improved production techniques. These inputs facilitate increased agricultural yields, creating a surplus which can then be directed to markets over the new roads.[3]

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[1]Hine, "Rural 'Feeder' Roads," in Transport Planning.

[2]Hughes in Haefele, Transport and National Goals.

[3]Wilfred Owen, "Road Transport and Food Production," Highway Research 125 (1966) p.2.

In Honduras and Costa Rica, rural roads allowed the introduction of new crops, increased use of fertilizers and insecticides, and the creation of rural industries providing inputs to, and processing outputs from, the agricultural sector.[1] New inputs in Malagasy included rice and coffee threshing machines, bicycles, motorbikes and autos, permitting an increased rice and coffee production.[2] In a village in Rajasthan, India, a five-mile hard-surface link road increased tubewell construction permitting sugar cane to be grown.[3]

Energy utilization changes along with construction of roads. In Brazil the percentage of farmers relying only on human energy dropped 25 percent between 1960 and 1970 as they were able to gain access to and afford animal power primarily, but also mechanical power as a result of new roads and general development of the area.[4]

In Thailand, Moerman notes that the ox plow was introduced in Ban Ping only after the road was improved sufficiently to allow the passage of carts, increasing the number of oxen owners.[5]

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[1] ROCAP, "Three Integration Roads."

[2] Mitchell and Rakotonirima, "Andapa-Sambava Road."

[3] Owen, Distance and Development.

[4] Private report of a major international lending institution.

[5] Michael Moerman, Agricultural Change.

Fertilizer use increased in association with the opening of roads in Thailand, Honduras, Central America, India, Malawi, Sierra Leone and elsewhere.[1]

Following the introduction of rural roads, dramatic qualitative changes in fertilizer usage took place in parts of Brazil over a ten-year period (1960-70). In 1960, 79 percent of the farmers were using only organic fertilizer, by 1970, 84 percent were applying only chemical fertilizer on their fields.[2] Delivered fertilizer costs are much reduced with hard-surfaced roads, and delivery is easier and more dependable. This latter consideration is extremely significant - farmers are more willing to invest and produce more if they can count on this vital input being available at the proper time in the production cycle.

A comparision of Malawi households within five miles of a road versus households further away yielded the following results with regards to inputs and technology:

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[1] Berger, "Study of Transport Investment"; IBRD, Labor and Capital Substitution; ROCAP, "Economic evaluation of Three Roads"; Owen, Distance and Development; Braida et al., "Sahel Transportation Infrastructure;" Arthur V. Patrick et al., "Sierra Leone/CARE feeder Roads II," (Monrovia; USAID, 1978).

[2] Private report of a major international lending institution.

	near road	away from road
no cash farm expenditures	12%	40%
use of fertilizer	31	2
use of oxen	47	0
use of plow	5	0
use of non-human equipment in farming	47	0
use of bore holes for water	55	27

Households near the road spent two and a half times as much for farm operations as those further away.[1]

d. Extension services, cooperatives, credit facilities

Roads increase the possibility of contact with government extension workers and other varieties of development assistance. Frequently the number of agents is grossly inadequate for the area they are assigned to cover and for the specific assistance needs of the farmers. They are therefore more likely to concentrate on those farmers within easy vehicle access. USAID found roads facilitate visits by government services, noting an increase in contacts with farm management technicians.[2]

The study presently underway in Kenya by Brokensha, et al., found that people are expecting visits from government officials,

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[1] Braida, et al., "Sahel Transportation Infrastructure."

[2] USAID, Philippines Evaluation.

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related to community development, social services, law enforcement and probation, health services and cooperatives, to increase significantly. Many people, instead of viewing improved roads as opening a door and creating an opportunity for self-help and local enterprises, saw the roads as bringing government aid and development programs to take care of their problems.[1]

In Sierra Leone, the agricultural extension service concentrated on villages accessible by road. One cocoa development officer had 50 percent of his contacts in villages served by feeder roads, 11 percent in non-road communities, and 39 percent on the trunk road. The swamp rice development officer figures were 50 percent, 24 percent, and 26 percent respectively.[2]

Roads have commonly stimulated the formation of cooperatives in finance, market and store commercial crops for the farmer, as well as to buy inputs such as fertilizer, taking advantage of economies of scale for production, storage, marketing, and purchasing of inputs, and bypassing middlemen. Likewise, cooperatives often obtain preferential access to credit. In New Guinea, village- or clan-owned trucks in the

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[1]David Brokensha, Peter Moock and Bernard Riley, "Kenya Rural Access Roads and Gravelling, Bridges and Culvert Program, Consultants' First Annual Report," (Draft.) (Washington; Devres, 1979).

[2]Patrick, et al., "Sierra Leone/CARE Feeder Roads II."

Mt. Hagen area spread so that most everyone had access to a motor vehicle for hauling or transport. In contrast, a World Bank study showed there was no cultural pattern of cooperation established in one Southeast Africa roads project that could support the cooperative purchase of trucks or vehicles so that roads had no effect on increasing cooperative transport effects.

Berger, in Southeast Asia, concluded that all-weather access for motorized vehicles is a key to effective extension service delivery and agricultural meetings. But this is also highly dependent on social structure and the degree of government emphasis on these programs. For example, only 25 percent of households surveyed in Thailand were reached by agricultural extension services versus 55 to 70 percent in Philippines, Malaysia and Indonesia. No association was found between access and the formation of or participation in farm organizations or agricultural training courses, which seem to be more a function of social structure. Local access may improve opportunities but other factors determine the extent to which this increased potential is realized.[1]

2. Agro-industry and non-agricultural enterprises

Roads are considered a primary stimulus to increased non-agricultural enterprises in rural areas but the exact nature of

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[1]Berger, "Study of Transport Investment."

the impacts is unclear. They are known to stimulate entrepreneurship and the development of retail stores and other commercial and industrial enterprises through increased economic activity. But there have also been several situations where increased economic competition has done more to harm commercial enterprises than to help them.

Numerous studies have documented the increase in business activities next to roads because of increased product availability and consumer demand. A TRRL report suggests that rural roads encourage the development of a widespread pattern of retailing in developing countries. In remote areas, permanent shops are established by the roadside to supply the local community as well as passing travelers with goods such as kerosene, clothes, shoes, cooking utensils, cosmetics and bedding, as well as building materials of corrugated iron, cement and wood. The retailers are dependent on the roads both for their products and their clientele.[1]

USAID found an increase from 78 to 166 commercial enterprises after six rural roads had opened in the Philippines. They included stores, storage facilities, rice and corn mills and

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[1] Hine, "The Appraisal of Rural Feeder Roads in Developing Countries," in Transport Planning in Developing Countries, p. 144.

cottage industries.[1] Another Philippine study found that, of the establishments put up after road construction, 59 percent were small stores, 33 percent were rice mills and 2-4 percent were sugar mills, small warehouses and market places.[2] In Thailand there was a 140 percent increase in shops, 20 new rice mills and a tapioca mill which could not have operated without the fuel brought by the road. Increased commercial competition in turn led to better prices for consumers. Surprisingly, however, hotels are said to have suffered because overnight stays were no longer necessary in traveling from one place to another.[3] In Madras, India, a 20-mile feeder road segment encouraged two bus companies to begin operations, the establishment of a regional milling and pottery industry, expansion of a fishing industry and the opening of many retail shops.[4] In Honduras and Costa Rica, rural roads stimulated the development of agro-industry: a dairy plant, oil processing plant, plywood factory, furniture manufacturing business, meat processing plant, and rice mill.[5]

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[1] USAID, Philippines Evaluation.

[2] Santos-Villanueva, "Value of Rural Roads," in Selected Readings to Accompany Getting Agriculture Moving, Raymond E. Borton, ed. (NY: Agricultural Development Council, 1966), p. 790.

[3] Berger, 'Study of Transport Investment."

[4] Owen, Distance and Development.

[5] ROCAP, "Three Integration Roads."

A recent AID study of the Padat Karya Rural Works Project in Indonesia followed road impact from increased production, to capital formation, to an increase in entrepreneurial activities due to the greater flow of cash into the region and easier accessibility. The effects were to reopen markets, increase sales, encourage the opening of small shops along stretches of the road selling "luxury" items, as well as a rise in scheduled transport services, including minibus service between settled areas, truck haulage for produce, and short hauls by horse carts, pedicabs, bicycles and foot.[1]

In a more short-term context, roads increase demand for consumer goods and thus aid retail development by the added cash coming into the economy as workers' wages for the labor-intensive construction of a road. The study in Kenya found that the top consumption priorities for wages were (1) buying of clothes (especially shirts, blankets, school uniforms), (2) livestock purchases (goats, cattle, chickens, sheep), and (3) school fees, food, corrugated iron, mattresses, ploughes, and for "business".[2]

The stimulation of non-agricultural enterprises by roads has not been found to be entirely beneficial in all studies. The effect of increased competition on the fragile developing economy

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[1]Ferdinand E. Okada, "Rural Work Project. Padat Karya Gaya Baru: Socio-Economic Assessment" for USAID/Indonesia, March 1978.

[2]Brokensha, "Kenya Rural Access Roads," p.2.

of an area of Indonesia caused a flurry of new activity soon after the road improvement, and resulted in some stagnation or elimination of numerous businesses over time due to over-competition.[1] Several other studies also contended that better roads bankrupt cottage industries because of the stiff competition from manufactured goods.[2]

Feeder roads in Sierra Leone are usually built at the instigation of mining companies or local chiefs to exploit mines, and bring in tractors, seed and fertilizer. The Kono road, however, was opposed by a mining company which feared that it would lead to illicit exploitation of diamonds, and traffic flow patterns indicate to Blair that this has indeed been the case. Less than half the entrepreneurs in Kono thought the road beneficial to their business and 40 percent found it detrimental. Only one business in Kono has opened as a result of the road, although shops had opened along the road.[3]

3. Employment levels

a. Short-term employment

Rural roads create short-term employment opportunities, both directly through the construction of the road itself and by

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[1]Okada, "Rural Works Project," p. 10.

[2]See Barwell and Hope, "Low-Cost Transport"; Blaikie, et al., Roads in West Central Nepal.

[3]Blair, "Highway in Sierra Leone."

increasing the ease of travel to short-term/seasonal jobs in close proximity of home. Many road projects are designed specifically to include a labor-intensive component. Wage employment may, in fact, be one of the major means for such a project to achieve objectives of redistributing economic resources and improving the standard of living of the poorer residents of the area. Labor-intensive construction is also seen as a means of creating a support group for the road project and reducing its cost, thus freeing up resources for other investments.[1]

The wage employment benefits derived from road construction is felt primarily by the poorer, local, young male population. In Kenya, a national survey showed that 92 percent of the workers were men, 50-65 percent were under 30 years of age, very few were landholders of any consequence, and 50 percent of the workers lived within four kilometers of the project road. The few women employed on the project were water carriers for the construction teams. (Some enterprising women sold porridge to the Siaya workers, thus gaining some economic benefits). A World Bank study of rural roads work revealed that in Bangladesh, however, women are used on construction teams, but at separate sites from the men, and are paid at a higher piece rate for their work. Indirect economic benefits from labor-intensive road

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[1]World Bank studies on labor and capital substitution.

construction are the acquisition of new skills and an increase in the ability and employability of the semi-skilled, as noted in Nepal.[1]

Labor demands for the road project must complement the agricultural cycle rather than conflict with it in order for it to be successful. Interest and involvement is likely to be much greater if the road construction can take up slack in the annual activity cycle and provide extra income when the need is greater. The Kenya evaluation team did not find the rural access road workers neglecting their farms. The workers could finish the allocated work by 1 p.m. and still have time left for chores, except during the harvest season.[2]

If sufficient attention is not paid to the local situation, however, the good intentions of labor-intensive construction have been known to run into problems. The World Bank, together with the Mexican government, has made studies of employment on Mexican rural roads programs. One of the three primary aims of the programs was to provide employment (the other two were national integration and economic development). At its peak in 1973, 300,000 persons were working on rural roads, overtaxing organizational abilities and decreasing labor productivity by almost half (6.3 man-years per kilometer versus 4.2). Since the minimum daily wage was twice that obtainable in agriculture, workers were drawn away and agricultural production dropped. As a result, payment was changed from a daily wage to task-based piece work, machines replaced labor wherever the

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[1]Blaikie et al., "Roads in Nepal."

[2]Brokensha, "Kenya Rural Access Roads."

latter was economically inefficient, design standards were improved, and more intensive organization was introduced at the state level to ensure adequate supervision. The program also was reduced in scope to encourage the resumption of agricultural activities to meet the consumption needs of the region.

Labor-intensive roads projects should take into account ethnic, religious and social factors affecting labor brigades and the appropriate mix of responsibility between government and community. They should build on existing work patterns and forms of organization to avoid socio-cultural upheaval. They should consider social norms as to who can do what, attitudes toward manual labor, cooperative forms of labor incentives and the availability of relevant skills. They should take care not to threaten village leadership and to avoid conflicts and factionalism. Good three-way communications between laborers, local community leadership and the central roads agency also is necessary. This may involve expanding the field engineers' roles, using community development agents, a hierarchy of community road associations and more formal monitoring mechanisms on the community-roads agency interface. [1]

After construction, the roads and bus routes between villages make it possible and feasible for farmers to live with their family and do their farm work, as well as casual paid work in nearby villages. Some can also do occasional seasonal work nearby if it is close

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[1] World Bank study of sociological impact on rural roads projects.

enough that frequent trips home could be made.[1] A road impact study in Central America found that bus passengers were recorded as using the bus between two and four times per month, a regular pattern associated with marketing or work activities.[2] Such an arrangement increases the poor's spendable income, but it also leads to a greater tendency for out-migration from an area.

In contrast to the direct employment of labor for road construction, roads may also tend to displace porters and other manual labor by the increased use of motor vehicles.[3] In Ban Ping, as elsewhere in Thailand, only ox cart owners can use the roads during the rainy season, and cart owners earn significant amounts of cash transporting rice and importing goods during that period.[4] Road improvements would eliminate their function and reduce their cash income.

b. Long-term employment

The long-term changes in employment resulting from feeder roads is more difficult to evaluate. As to some generally positive results of roads, increased agricultural production, and new commercial and industrial enterprises will open up new jobs or provide fuller

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[1]Hine, "Rural Feeder Roads," p.143.

[2]Private report of a major international lending institution.

[3]I.J. Barwell and J.D.G.F. Howe, "Appropriate Technology and Low Cost Transport." in Low Volume Roads: Second International Conference. Washington: National Academy of Science, 1979); Blaikie et al., "Road Construction in Nepal," Edwards, "Evaluating Investments in Rural Transport."

[4]Moerman, Agricultural Change.

employment for the villagers. Construction of roads leads to a diversification of economic activity and to individual specialization over the long term. Long-term employment changes occur within the village as new enterprises and economic activities enter the economy and more persons may remain in rural areas to work as a result. Rather than giving up agricultural activities, roads lead villagers to supplement agriculture with miscellaneous cash earning projects. One World Bank study shows that in the Yucatan area the arrival of the road opened up the honey markets so villagers began to raise bees and market the honey as an alternative to other economic activities. Some people with skills such as masonry began to use the road to work outside the villages as laborers.

Roads may not contribute much to the solution of long-term employment problems in rural areas, and they may have detrimental impacts on the people and families in the areas they serve. The emigration of farm labor was a major reason for the lack of benefits of the Kono road in Sierra Leone.[1] Jackson found that in Colombia jobs were short-lived, the disappearance of the jobs was soon followed by "instant underdevelopment."[2] Hughes found only isolated instances of changes in occupation, most new trades going to newcomers.[3] In some instances

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[1]Blair, "Highway in Sierra Leone."

[2]Jean E. Jackson, "Colombia: Instant Underdevelopment for Indigenous Tribes," ARC Newsletter 2, 1978.

[3]Hughes in Haefele, Transport and National Goals.

employment and underemployment problems did not change substantially, except during construction of roads.[1]

4. Land values, tenure and use

The impacts on land value, tenure and use due to the construction of rural roads are inextricably linked together in considering the situation of the rural poor. In general, a new road causes the value of the surrounding land to rise in direct proportion to its proximity to the road. Thus, the fortuitous geographic position of the various social and economic components of the population in relation to the road affects their relative economic positions. Both rising land values and the changing structure of the population as a result of the road impact on the land use patterns, in general moving toward more intensive land utilization closer to the road, both for agricultural and commercial enterprises.

Land values increase after a road is built. Therefore whoever owns the land will benefit most and large farmers will benefit more than small ones. As would be expected, the evidence suggests that the magnitude of the increase in land values does have some positive relationship to density of population and type of road, although no single author suggests this conclusion. In Nepal, as soon as the road alignment was known, land values rose "to many times their former levels" for roadside locations and at least double for plots 100 meters

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[1] World Bank study of selected highway projects.

or more away. The attraction of reduced costs for transporting agricultural goods to market, the potential for retail establishments alongside the road to serve the road users, as well as the close proximity to the social services made available by the road increased the market price of land in the area and increased the number of land transactions.[1] The size of the increase, of course, depends on the relationship of the land area in question to the road and on the quality of the land. In the Philippines, land value increased from 39 to 77 percent the year after the road construction as compared with the year before due to better prices and production possibilities. Coconut and residential land experienced the highest rise (77 and 72 percent, respectively), uncultivated land was up 53 percent, rice land rose between 40 and 50 percent and coffee land experienced the least increase (39 percent). Residential land still ranked first in value after the value increase.[2]

The Ramnad-Mandapan road study in India found increases in the value of unirrigated land as follows:

% increase in value	number of villages
0	1
0-25	7

[1]Blaikie et al., "Roads in Nepal."

[2]Santos Villanueva, "Value of Rural Roads."

% increase in value	number of villages
25-50	9
50-75	5
75-100	2
100	1

The value of irrigated land increased by 33 percent to 150 percent.[1] Land values also increased in the Philippines, Honduras and El Salvador as a result of road projects.[2] It may be that a rise in land values close to a road may cause value of land further away to fall, but no definitive discussion of this issue was found in the literature.[3]

In the Padat Karya project in Indonesia, land values rose at least 50 percent for plots immediately adjacent to the road. This is a lower average than experienced elsewhere perhaps in part due to the lesser traffic volume expected and to the lack of land speculation due to villagers' expressed reluctance to sell. This reluctance stemmed from the high social value placed on land; productivity and a neighbor's esteem was considered more important than monetary value. Land values further away from the road usually did not change, supporting this hypothesis. However, unexplained variance was discovered

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[1] India, "Ramnad-Mandapam Road".

[2] USAID, "Philippine Evaluation;" ROCAP, "Three Integration Roads;" Hirsh in Wilson, et al., Highway Investment.

[3] Cf. OECD, Conference on Rural Roads.

in the Padat Karya study. In one place, for example, an increase of only 5 percent was found, whereas "marked increases" of ten times or more occured in other places, especially West Java.[1]

A frequent effect of rural roads projects is that land values along the road increase and displace tenants or those who do not have their land legally registered, those who have less access to early information systems and less ready cash or credit, or those who, because of their subsistence orientation, place less value than do large farmers on land proximity to roads. If such displacement and dispossession occurs it may increase the disparity between rich and poor and increase the number of landless in the region.[2]

In Kenya, increasing recognition is being given to a "roadside elite" consisting of a disproportionately wealthy group of farmers, rural businessmen, and professionals who are buying up the more productive and valuable land alongside the roads. The poorer farmers of the land are therefore being relegated to more remote areas. Indications from donor agencies, projects in West Afirca, Southeast Asia, and Central America also suggest that poorer farmers may be forced out as land values increase.[3] In Bangladesh, the improvement of roads has led to landholding concentrations and an increase in the landless

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[1] Okada, "Padat Karya Project."

[2] World Bank study of sociological impact of work on rural roads.

[3] Ibid.

populations as well.[1]

The lack of compensation to the owners for land used for roads was mentioned by farmers as a cause of dissatisfaction in Sierra Leone and Bangladesh.[2] In addition,

> Bank staff experience has shown that compensation provided may not fully compensate (a farmer) for the real cost of loss of land. Roads may divide the farmer from his farm land or his water supply, and may divide up the land in such a way that he loses the use of a major proportion of it. Or, the road may require a few community members to provide most of the land for right-of-way but the payment provided may not help them to replace the land lost. For instance, there may be no available land in the area...The result may be that the farmer simply has less land t, farm, may omit the fallow cycle, which eventually may cause loss of land fertility.[3]

The effect of cutting a new road on land use and settlement patterns are quick to be seen. In Ghana, the increased ease of movement made possible by a new road attracted whole villages to the roadside and caused land within easy access of the road to be more extensively cultivated. Zones of cultivation developed along the road, and the fallow periods declined, with the introduction of cash crops hitherto unknown in the area. In areas remote from the road, cultivation almost ceased.[4]

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[1]Edwards, "Evaluating Investments in Rural Transport."

[2]Blair, "Highway in Sierra Leone;" Berger, Study of Transport Investment.

[3]World Bank study of sociological impact of Work on rural roads.

[4]H.P. White, "Communications and Transport," in Raymond E. Barton, ed. Selected Readings to Accompany Getting Agriculture Moving, Vol. II (New York, The Agricultural Development Council, 1972), p.800.

In Sabah, a TRRL study noted that almost 100 percent of the useable land was cultivated within one-half mile of the road, but that percentage fell off to about five percent at a distance of five miles from the road.[1]

In the case of penetration roads, spontaneous colonization has often led to insecure tenure which has immediate or delayed negative consequences. In Nepal, a wide variety of immigrants followed the progress of new roads into the lowland terai, frustrating government attempts to retain some areas as forest preserves. Conflict with, and corruption of, local officials were quite common, and the "means by which each [immigrant] attempted to establish rights over the land depended upon their [sic] access to the bureaucracy, particularly those sections dealing with land registration."[2] For those who could not obtain land, illegal squatting or sharecropping were the common options.

Problems may be encountered in selecting and obtaining rights of way for road placement. For years a road was needed to serve a village in the Philippines as children could not go to school, and farmers could not move produce or animals. But proposed roads had been rejected because it would cut through farm plots, take more land

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[1]R.S. Millard and R.S.P. Bonney, "Road Transport in Developing Countries," Munich: 7th International Road Federation World Meeting. 1973, p p. A 2-5.

[2]Blaikie, et al., Effects of Roads in Nepal, p. 47.

from some than others, and necessitate new surveys for land titles. Finally, a proposal was made and accepted for a "crooked road" that zigzagged along the edges of properties.[1] Schroeder and Sisler mention that in Nepal feeder roads may take up valuable scarce paddy fields, and that it may be better to transport wheat and rice across fields than to build too many roads.[2] In some countries road shoulders are used to graze cattle (as in South Asia), and ditches and culverts are used for irrigation (as in Yemen). If roads are not designed with these factors in mind it may put farmers at a disadvantage and lead to abuse of the road and higher maintenance costs.[3]

B. Marketing

Road development leads to reduced transportation costs to and from markets, and thus increases the amount and influences the nature of farm-to-market activities undertaken by rural areas. Agricultural input and output levels are affected. Inputs become cheaper, more easily and reliably obtained, and can be integrated into the agricultural cycle. The amount of commercial crops available for marketing increases with the opening of roads because of (1) increased inputs, (2) ability to move goods to market and high demand areas which means a greatly enlarged market for surplus goods, and (3) reduced transpor-

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[1] Pedro T. Orata, "Community Education in Rural Philippines", Overseas Education, April 1954.

[2] Schroeder and Sisler, Sonauli-Pokhara Highway.

[3] World Bank study of sociological impact of work on rural roads.

tation costs (if passed through) which mean higher profits for farmers, and act as an incentive for further production. Marketing patterns adjust, including place of sale and sales agent, to fit the new economic climate created by the roads.

The impact of roads on the rural marketing structure is to establish a firm link between agricultural producing areas and marketing centers. The new ease and decreased cost of transporting goods to market initially provides farmers with a means of disposing of surplus produce and the decreased transport costs increase the farmgate price to the farmer (price of goods sold minus transport costs) and his rate of return. One Central American study found that freight rates were down to 13-25 percent of the original rate (from 1970 to 1978) and passenger rates down to 37 percent of original level, and no rate differences were observed between the rainy and dry seasons, whereas there had been previously.[1] The attraction of a ready market for goods, promise of increased returns on production investments and increased ease of obtaining agricultural inputs lead to an increase in area and intensity of cultivation, and of yields to send to market.

The induced agricultural surplus is sold and exchanged at the point of production, the centralized urban markets, and at spots all along the way. Producer distance from the market as well as the

[1]Private report of major international lending institution.

existing transportation system and type of good determine where and by whom the products will be sold.

Close proximity to market, measured by transit time, encourages farmers to bypass the middlemen and market their own goods in order to collect the entire profit from the sale; in so doing, farmers have been known to receive 25 to 40 percent more for their goods.[1] Better transport increased the use of market places in Thailand when a laterite road from Chiang Rai to Chiang Kham reduced travel time from three days to three hours, and altered the routes and prices of the regional rice trade.[2] In the Philippines, construction of a rural road reduced the sale of farm products at the farm rather than market from 69 to 40 percent of the amount sold.[3] As several studies have pointed out, benefits are likely to be felt primarily by those producers located immediately adjacent to the roads. Those further from the road will follow a marketing pattern similar to those producers who are relatively far down the road in relation to the market.

For producers at the far end of the rural road from the market, one study suggests that the point of sale moves closer to the farm.

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[1]Okada, "Padat Karya."

[2]Moerman, Agricultural Change.

[3]USAID, "Philippine Evaluation."

This is due, at least in part, to the increased number of middlemen who make the longer journey in search of producers wanting to sell their goods without traveling to market. Previously, these producers would have gone to central collection points somewhere between their farms and the market. Ease of transportation and increased competition has extended the territory of the middlemen, as seen in studies of Philippines, Malaysia, Indonesia and Thailand, among others.[1]

The cost of transporting one unit of goods decreases with the construction or improvement of roads, through the replacement of foot, horseback, and animal-drawn carts with jitneys and other motor vehicles, and thus increases farmers' income from sales at market. One study determined that once a road is converted to a minimal all-weather road and motorized vehicles are used that transportation costs usually drop to less than five or ten percent of the total product costs.[2] For some goods the degree of savings is higher than others, depending on weight and bulk. To illustrate, a Philippine study identified percentage drops of transportation costs from the year prior to road construction to the year following for a number of agricultural products. Cost of transport of root crops dropped 60 percent and other products (corn, bananas, swine) experienced significant decreases as

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[1]Berger, "Study of Transport Investment."

[2]Private report of a major international lending institution

well. Tobacco experienced the smallest, although still significant, decrease of 17 percent.[1] However, a study in Thailand concluded that whereas the savings in transport cost makes a significant difference in return to "heavy" crops like cassava and sugar cane, it is of little consequence with most other upland crops. A World Bank study shows that for corn, the savings would represent an increase in net return of one percent.[2]

As truck and vehicle operating costs decrease, this results in increased profits for trucking and commercial transport firms which induces them to expand their vehicle numbers. Increased competition may reduce freight rates. In the Philippines, passenger and cargo charges fell 54 percent from 1975 to 1978 due to lower transport costs and increased competition. Transport became more reliable due to a 284 percent increase in number of vehicles, and began year-round operations rather than during the dry season only. Longer-distance vehicles cut down on transfer time between vehicles. Average farmgate prices increased 59 percent while market prices were up by 26 percent, so farmers were getting a larger share of the price. In Honduras transport was formerly by mule at a cost of $0.20-0.25 a load, after

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[1]Santos-Villanueva, "Value of Rural Roads."

[2]World Bank study on village access roads.

[3]USAID, "Philippine Evaluation."

a road was built the cost was cut to $0.05 by truck. On another 4.5 kilometer road there is a daily bus service to Tegucigalpa, allowing villagers to save $0.10 on each straw basket marketed.[1]

The degree to which transport costs savings are passed on to the consumer-producer is important. The Brookings study concluded that in all cases examined, except El Salvador, the mechanism which had stimulated additional output was transport rate reductions. Another regional study asserted that in most cases the transport benefits had reached producers and consumers.[2]

It has been noted, however, that even if transport savings are passed on, they may be so small as to have no effect on consumer - producer behavior.[3] In Bangladesh, the maximum reduction for a transport improvement (from head and shoulder loading to pedal rickshaw or truck) is unlikely to save more than 5 taka per pound. This is a very small savings relative to a reduction in interest rates from 100 to 50 percent, which would save the average farmer several hundred taka annually, or in light of the fact that market prices of rice fluctuated from 40 to 261 taka from 1972 to 1975.[4]

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[1]World Bank study of labor and capital substitution.

[2]World Bank study of selected highway projects.

[3]OECD, Conference on Rural Roads.

[4]Edwards, "Evaluating Investments".

To conclude, roads frequently serve to reduce price differentials and disparities in marketing opportunities between formerly isolated villages and market centers. Numerous studies have found that the crucial factor in successful development of new land is access to a viable market center. Markets are principal bottlenecks, a situation frequently aggravated by high transport costs on poor roads. Land settlement patterns in Bolivia reflect this: as distance from market increases, the percentage of arable land in crops decreases (within 14 kilometers from the paved road this drops to only one percent).[1] In India, a 1967 report by Uttar Pradesh state government noted that a major factor in the state's poverty and food deficiency was its inability to market crops or obtain inputs, since 36 percent of its villages were without roads. Farmers could not drill enough tubewells because road accessibility was required for drilling equipment.[2] Thus, lack of roads limited marketing exchanges significantly enough to hold back development of the whole region.

C. Consumption Effects

The impact of new roads on consumption of goods and services is generally positive, although complementary projects are often necessary.

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[1] Wennergren and Whitaker, "Investment in access roads."

[2] Owen, Distance and Development.

Increased consumption is often a highly visible indicator of relative changes in income compared to prices, i.e., either an absolute increase in income or absolute or relative declines in prices, or both.

Researchers have observed visible signs of increased consumption following introduction of roads in nearly all cases: zinc roofs, private wells, latrines and radios in Liberia; metal roofs, more rooms, stone construction, more furniture, lighting (but not sanitary facilities) in Madagascar; masonry houses in Mexico.[1] In Thailand, households surveyed had 51 percent more consumer assets (metal roofs, radio, bicycles, motorcycles, electricity) after a road was built than before due to greater access, more competition and lower prices.[2] In Haryana, India, housing costs declined because the cost of transporting bricks and other materials fell to a tenth of what it had been by camel.[3] Increases in the number of recreational activities and social visits was also commonly noted, particularly in Asian countries. In the Philippines, roads contributed to increased recreational activities, movie-going, musical competitions, celebrations and visits between friends and relatives.[4] Social visits

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[1]Ellis, et al., "Liberia Rural Roads;" Mitchell and Rakotonirina, "Andapa-Sambava Road."

[2]Berger, "Study of Transport Investment."

[3]Owen, Distance and Development.

[4]USAID, "Philippine Evaluation."

comprised the major and unexpected immediate benefit of a World Bank-financed rural highway in Papua New Guinea.[1] Social visits also increased in Thailand and Nepal.[2]

On occasion, outward signs of increased consumption are negligible, as in Malaya following one road project.[3] No information was available as to why this was so, or what income effects, if any, the project had. Another situation in Sierra Leone was ambiguous in its consumption effects.[4] After two years, villagers near roads did own a few more material possessions (umbrellas, plastic buckets, radios, motorbikes, bicycles) and 11 percent of the houses in road villages had been built in the time since the roads were introduced, compared to 5 percent in villages not on roads, indicating some increased economic activity associated with roads. Yet the author found little evidence that roads had increased contact with a monetarized economy or made villagers more materialistic, possibly because the roads had been introduced so recently.

1. Health and Education Services

There is an implicit debate in the literature concerning the impact of rural roads on health and education services. Some

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[1]Marion W. Ward, The Rigo Road: A Study of the Economic Effects of New Road Construction: New Guinea Research Bulletin No. 33, 1970.

[2]Berger, Study of Transport Investment;" Blaikie et al., "Effects of Roads in Nepal."

[3]Hughes in Haefele, Transport and National Goals.

[4]Patrick et al., "Sierra Leone/CARE Feeder Roads."

researchers found little improvement in access to such facilities and in health and education levels as a result of new roads. For example, in Liberia, Hansen found health and education to be the factors least influenced by rural roads improvement, claiming that these were more dependent on distance to market centers.[1] Edwards argues similarly that health and education facilities do not improve because of strong centralizing pressures.[2] The major part of the literature, however, does seem to agree with Shoaib that access to health and education usually improves more rapidly along roads than elsewhere.[3]

a. Health

With respect to health this conclusion is confirmed by studies documenting increased numbers of health clinics or visits by health personnel associated with road improvements, by increase in the use of hospitals, dentists, and veterinarians, and by a decline in use of native medical specialists.[4] The farmers perceive such

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[1]Charles E. Hansen, "Evaluation of Planned Road Construction in Liberia: Quantitative Analysis of Socio-Economic Data." Vol. 1, New York: Checchi and Co., 1976.

[2]Edwards, "Evaluating Investments."

[3]Shoaib, "Comparative Evaluation."

[4]Berger, "Study of Transport Investment," Hirsh in Wilson, Highway Investment;" Kasiraksa, "Friendship Highway;" USAID, "Philippine Evaluation;" Owen, Distance and Development; Hughes in Haefele, Transport and National Goals; Ward, The Rigo Road; Okada, "Padat Karya;" Patrick et al. "Sierra Leone/CARE Feeder Roads;" Blaikie et al., "Effects of Roads in Nepal;" Ellis et al., "Liberia Rural Roads." One exception occured in the Yucatan where local bonesetters expanded their clientele following opening of the road (World Bank study on rural development).

services, especially in an emergency, as a major benefit attributable to roads.[1] When queried as to their use of a new road in Panama, farmers named medical attention as their first choice.[2]

In general, the relationship between access to medical facilities and health is clear. There are, however, many indirect or associated effects of rural roads on health and nutrition which may not always be positive. For example, a shift to cash crop production, accompanied by buying food at the market, frequently leads to declines in dietary standards.[3] In one Northeast African country, more imported goods lessened nutritional standards of the poor.[4] In Bangladesh, a switch from rice to more marketable watermelon resulted in poorer nutrition for farmers.[5]

Milton reports that Aymara and Quechua families who follow new roads into the low moist Yungas find that they can grow only high carbohydrate crops like bananas, yucca, huabusa and racacha, all seriously deficient in plant protein.[6] The result is protein malnutrition which can seriously damage infants' brains and nervous systems.

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[1] Berger, Study of Transport Investment.

[2] Private papers of a major international lending institution.

[3] World Bank study of sociological impact of work on rural roads.

[4] World Bank study of selected highway projects.

[5] Edwards, "Evaluating Investments."

[6] Milton in Farvar and Milton, Careless Technology.

This may cause irreversible damage condemning whole generations to poor health and degradation.

The initiation or increased effectiveness of anti-malaria programs accompanies road improvements.[1] One World Bank study reveals that a road in a northeast African country induced the government to undertake malaria eradication, permitting new settlements in previously uncultivated lowlands.[2]

Edwards, however, notes that better access may mean less emphasis on preventive (vs. curative) medicine.[3] Brokensha et al. agree that better health depends more on environmental, educational and preventive measures rather than curative ones. For example, malaria is common along the Siaya road and hospital visits will not lower its incidence. The environmental causes must be dealt with.[4]

Roads serve to spread diseases, as African river blindness in Brazil or hoof and mouth disease in the Colombian Chocó, by exposing previously isolated areas to foreign germs or vectors for which they have no immunity or curative methods.[5] A principal rationale for not funding the last connecting segment of the Pan-American Highway in

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[1]Hirsch in Wilson et al., Highway Investment.

[2]World Bank study of selected highway projects.

[3]Edwards, "Evaluating Investments."

[4]Brokensha et al., "Kenya Rural Roads."

[5]Davis, Victims of the Miracle; Jackson, "Colombia."

the Darien Peninsula is the failure of the Colombian Government to control hoof and mouth disease in the Chocó. New roads into the Brazilian Amazon have decimated or wiped out the Parakanam, Kreén-Akaróre, Yanamamo and many other ethnic groups primarily as a result of the introduction of influenza, dysentery, measles, tuberculosis, venereal diseases and other diseases.[1]

Penetration roads also introduce settlers to unfamiliar climates, for which habits formed elsewhere may be inappropriate. In Bolivia's tropical Yungas, the highland-type house with small windows provides inadequate ventilation, contributing to health problems. Increased exposure to tropical diseases and parasites is also common.[2]

Improved roads in Liberia, Guinea and Sierra Leone have allowed easier movement of cases of trypanosomiasis (sleeping sickness).[3] For example, on the Kissi road, passengers stop to refresh at river crossings where they become susceptible to bites of the tsetse flies. Flies are also attracted to moving vehicles and may be carried by them for miles, a fact instrumental in spreading the disease to former tsetse-free areas. Labor migrants from savannah areas into

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[1] Davis, Victims of the Miracle.

[2] Milton in Farvar and Milton, Careless Technology.

[3] Z.H. Abedi and Max J. Miller, "Roadside Tsetse Hazard in Liberia," American Journal of Tropical Medicine and Hygiene 13, 1964.

southern Ghana brought sleeping sickness with them. Though eradication programs were successful in the savannah, returning migrants kept bringing the disease back. Today, the disease rate is highest among adult males (who migrate most). Among the Ashanti and in Nigeria, the highest incidence occurs along roads. Evidence indicates that a formerly disease-free area in Karawa was infected from a forest along the main road where people stopped to rest.

> Roads are thus linear-type transmission sites. Although systematic epidemiological data are not numerous, modern roads built for economic development seem to constitute a major health hazard in endemic regions. Their very purpose being to encourage movement and mixture of peoples and goods but having, as implicated effects, the facilitation of manvector contacts for several kinds of insect-borne diseases.[1]

b. Education

The impact of rural roads on education seems less direct than with health. Several authors have even noted little changes in education levels as a result of road improvements.[2] However, roads often stimulate the opening of new schools, teachers are encouraged to come to villages, more children are able to attend schools away from home due to better access and increased ability

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[1] Hughes and Hunter in Farvar and Milton, Careless Technology.

[2] Berger, "Transport Investment," Hirsch in Wilson et al. Highway Investment.

of parents to pay fees.[1] The results of these changes may be an increase in length of schooling, lower drop-out rates, more consolidated schools and more opportunities for girls as students and women as teachers.

A study of new roads in Costa Rica found that the finished road did not directly influence attendance at the many primary schools within walking distance of most areas, but that it did affect the secondary school attendance. Over half of the students live along the last 30 kilometers of the road and were directly dependent upon the state subsidized school transportation program to get to one of the fewer secondary schools.[2]

Brokensha et al. state that isolated schools in Kenya are not favored by teachers who desire good access to their homes, and to shops and services, and that these schools receive fewer books, supplies and visits from educational officials.[3] Roads could therefore have a favorable impact by lessening the isolation of rural primary schools, as well as facilitating access to secondary schools.[4]

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[1]Hughes in Haefele Transport and National Goals; Kasiraksa 'Friendship Highway;" Owen, Distance and Development; USAID, "Philippine Evaluation," Ward, Rigo Road; Okada, "Padat Karya Project;" Brokensha et al., "Kenya Rural Roads."

[2]Private report of major international lending institution.

[3]Brokensha et al., "Kenya Rural Roads."

[4]World Bank study of socio-economic impacts of rural development in the Yucatan.

The percentage of population having some schooling, the grade level reached and literacy were found to be correlated with access in Liberia. But there was no correlation between access and the number of students enrolled in school, perhaps because of mission schools located in isolated areas.[1]

D. Distribution of Impacts

1. Distribution of impacts by socio-economic groups

As mentioned in Part I above, in recent years a great deal of interest has been placed on the distribution of road impacts--who pays and who benefits? The distribution of benefits between transporters and producers-consumers has been discussed above in II B and the spatial impact is discussed below in II E.

It seems usual that those in a better position to take advantage of road improvements (landowners near the road, middlemen, retailers, truckers, urban dwellers, upper and middle income levels) will profit most in the absence of specific programs to counteract this. This is the core of the studies presented by Blaikie et al., Brokensha et al. and others.[2] The immediate effect of road projects in Bangladesh is

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[1]Ellis et al., "Liberian Rural Roads."

[2]Blaikie et al., "Effects of Roads in Nepal; "Brokensha et al., "Kenya Rural Roads."

the replacement of headloading by rickshaws and trucks, resulting in unemployment for the poorest. Cottage industries are hurt. Lost employment lowers income, often intensifying health and educational problems for the poorest. According to Edwards, the fundamental effects of roads is a reinforcement of the development of capitalism, widening of income disparities and concentration and centralization of capital.[1]

Where there are large landholders, one could not expect road improvements to spur production increases since landowners already enjoy sufficient income and they fear that additional income would liberate their employees.[2] Land tenancy will therefore be a major factor in determining who benefits; if land is unevenly distributed, as in parts of the Third and Fourth Worlds, the landless or land-poor will receive little benefit, but if land is more evenly distributed, as in some areas of Mexico, road projects will serve lower income groups better.[3]

In Kenya, Brokensha et al.[4] give specific examples of well-off truckers, traders and farmers who are in a position to take advantage

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[1]Edwards, "Evaluating Investments."

[2]Shaughnessy et al., "USAID/CARE Food for Relief Roads."

[3]Personal Communication, staff of an international financial institution.

[4]Brokensha et al., "Kenya Rural Roads."

of new roads. According to these researchers, while rural roads may benefit the area as a whole, there is always a group, the poorest and most disadvantaged, who will not be reached. There is no way to prevent those who have an edge in resources, skills and initiative from benefiting disproportionately.

"Self-help" projects often become exploitation of the poorest and least influential villagers on whose shoulders the manual labor will fall. In Indonesia, one road (among many) apparently had not benefited the bulk of the people. In fact, it had reduced employment opportunities (such as porterage).[1] Weiss found that roads in northeast Brazil would have no positive impact on the prevailing skewed pattern of income distribution.[2] Ward found that the first to take advantage of the Rigo road were Europeans, although she believes indigenous cattle raising and store operations seem probable in the near future.[3]

The elite also emerge as principal beneficiaries of income generated and of distribution of opportunities and services.[4] In fact, the concept of rich and poor had grown in what was once a nearly egaliterian

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[1]Okada, "Padat Karya Project."

[2]Joseph Weiss, The Benefits of Broader Markets Due to Feeder Roads and Market News In Northeast Brazil. (Ithaca, Cornell University Press, 1971).

[3]Ward, The Rigo Road.

[4]World Bank study of socio-economic impacts of rural development in in the Yucatan.

ejido community. Particularly significant in the increasing social stratification has been the emergence of patron-client roles; unlike before the road, many agriculturalists are now working as day laborers, and members of the new elite have begun to extend credit to poorer individuals in exchange for labor.

World Bank studies note several barriers to equitable distribution of road benefits: no pass-through of savings by middlemen, land tenure, and agricultural credit systems (as in Brazil) that benefit landowners but not tenants. The implication for policymakers, therefore, is that road projects must be complemented by programs to promote competition among transporters, land reform, and access to credit.

However, a number of studies have found that road improvements can be associated with lessening of income differentials. In the Philippines, reduction of transport time and fares would seem to benefit the rural poor.[1] In Haiti, access roads along with coffee centers and credit associations were credited with increasing the income of small farmers much more than large farmers as follows:[2]

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[1]USAID, "Philippine Evaluation."

[2]Hoskins-Western-Sonderegger, "Haiti."

land owned (acres)	income increase	increased production
0-3	74%	87%
3-5	11%	20%
5+	decreased	decreased

The middle group showed the highest improvements in housing and livestock ownership. "Presumably" the poorest group used increased income to better their diet, clothing and perhaps increase landownership. Participation in the small farmer development project ran counter to the trends observed elsewhere in Haïti where the rate of return on crops increased as farm size increased.

Mitchell and Rakotonirina found a narrowing of differentials between farmers and non-farmers. From 1965 to 1975, average disposable cash income (the total income net of self-consumption and production expenditures) increased 24 percent for farmers, 148 percent for craftsmen, 127 percent for employees, 102 percent for traders. In 1965, traders' disposable income was ten-fold higher than farmers'; in 1975 it was only four-fold higher. Average disposable cash income per household in the top decile was 54 times that of the bottom decile in 1965, but only 32 times in 1975. However, the top decile still enjoyed 42 percent of all disposable cash income (compared to 52 percent in 1965). Engel's law that percentage of income spent on food decreases as income increases held between rich and poor (traders spent 41 percent

on food and farmers spent 79 percent in 1975), but did not hold over time despite an increase in income because food prices rose disproportionately (they increased 90 percent whereas other prices rose by only 75 percent) and a more varied supply of imported foods was consumed.[1]

Berger, whose study of road projects in four Southeast Asian countries focused on their impact on income distribution, concluded that changes in production patterns and agricultural innovations were fairly evenly distributed across all socio-economic groups, but the lack of equity in access to services was a constraint on regional production. Income levels had risen, but the range of income levels had widened. Where export cash crops were most important, there was a tendency toward greater income stratification. Where domestic food crops were grown, there was greater income equity. This is because high-income farmers are most likely to participate in cash cropping, use fertilizers, extension services, and credit, and exhibit innovative behavior and risk-taking. As a region undergoes economic growth, income gaps widen both absolutely and relatively.[2]

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[1]Mitchell and Rakotonirina, "Andapa-Sambava Road."

[2]Berger, "Transport Investment."

2. Geographic distribution of impacts

The area of influence of a road varies according to type of road, topography and economic or other effect. Often project planners arbitrarily define this area, such as in Mexico where the zone of influence is taken to be the distance within one day's travel using any available transportation. Berger, in the study of the impact of feeder roads in Southeast Asia, defined an impact zone of ten kilometers, except where separated by a major physical barrier, or served by a closer alternative route.[1]

Using the standard of economic effect, the literature shows differing conclusions. Boonchuan found the extent of influence of the Friendship Highway to be three kilometers on either side.[2] Squire, noting the tendency for settlement along lines of communication (roads and waterways) posits a maximum of three or four kilometers,[3] while Ward found the economic effects of the Rigo road extended "several miles" beyond vehicle access.[4] Mitchell found that farmers within five kilometers of the road gained almost 50 percent more income than less centrally located farmers.[5]

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[1]Berger, "Transport Investment."

[2]Lyn Squire; "Optional Feeder Roads in Developing Countries: The Case of Thailand," Journal of Development Studies 9, 1973.

[3]Ibid.

[4]Ward, The Rigo Road.

[5]Mitchell and Rakotonirina, "Andapa-Sambava Road."

Road alignment is an important consideration, too. In Sabah, location of a road along a steep ridge is less likely to stimulate development than one in a valley.[1] However, in Nepal, placement of the rural arterials in the valleys limited their impact on the majority of the population living in the healthier climates of the hills above.[2]

Bonney found that in Sabah the standard of feeder roads bears a relationship to the value of output at varying distances from the market. All-weather roads were associated with development up to 25 kilometers from the market, earth roads up to five or ten kilometers. Bonney showed that there also exists a relationship between area devoted to export crops and effective distance from a main commercial center, with the area of influence tending to be shaped like an isosceles triangle with the road running from the center of the base to the apex. Intensity of cultivation seems to vary within this area, decreasing in yield and increasing in cost of cultivation by a factor of 20 percent per kilometer.[3]

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[1]Bonney, "Place of Transport."

[2]Blaikie et al.,"Effects of Roads in Nepal."

[3]Bonney, "Place of Transport."

E. Spatial Considerations

1. Urbanization

A World Bank study of selected highway projects found that urbanization--either consolidation of one city at the expense of towns, or the growth of several towns--was associated with the increased importance of commerce and tradesmen buying more commodities from more places which in turn was the result of improved roads.[1] The construction of a feeder road linking one Mexican village with the main Yucatan highway tended to strengthen the village as the service center of the surrounding townships. Government and business functions centered in the village, and population grew at a higher rate than the national average. In Nepal, Blaikie et al. found that the introduction of inter-urban roads linking the hill towns with the capital, Kathmandu, and the lowlands (as well as India) tended to strengthen particular towns as administrative centers; however, increased economic functions continued to elude these towns inasmuch as the prevailing economic condition of the country was poor and most commerce was linked to production elsewhere.[2]

2. Migration

There is a wealth of research on migration (both rural-

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[1]World Bank study of socio-economic impacts of rural development in the Yucatan.

[2]Blaikie et al., "Effects of Roads in Nepal."

urban and rural-rural), some of which touches upon the role rural roads and increased access play in facilitating such migration.[1] Traditionally, roads are seen as enabling and encouraging migration through cheaper and easier transport, more information on opportunities, more exposure to the affluence of outsiders and the possibility of a prompt return home. In general, however, such literature does not treat the role of roads in any great detail; its concerns are focused elsewhere, especially on the highly complex interaction of social factors influencing migration. Where references are made to the role of roads, it is often assumed and occasionally evidenced that roads are neither a necessary nor a sufficient condition for migration.

However, the provision of roads linking villages with larger towns has often served to reduce the effective distance between them and to encourage rural-urban migration. Two-step migration from areas further from urban centers changes to one-step migration with road improvements.[2] Other research by Connell et al. in India hypothesizes a cultural gap acting as a restraint on migration which can be reduced (due to decreases in transport cost and time, and greater

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[1] See Anthony Richmond and Daniel Kubat, Internal Migration: The New World and the Third World, SAGE Studies in International Sociology, (Beverly Hills, Ca. 19760; and John Connell, et al., Migration from Rural Areas: The Evidence from Village Studies, (Delhi: Oxford University Press, 1976), for a representative view of migration research and for further bibliographical material.

[2] George Foster, Traditional Societies and Technological Change. (New York; Harper and Row, 1973).

information) by the provision of a road.[1]

The nature of the interaction of village and town is complex, however; mere proximity to roads or towns does not necessarily stimulate migration. There is evidence that improved roads can facilitate commuting from villages to nearby urban areas. "People living in places very near towns can enjoy many benefits and avoid the inconvenience of actually migrating."[2] This finding suggests that low-volume rural roads, as well as increased agricultural production and income, may provide the means for rural inhabitants to commute more easily to and enjoy the benefits of, nearby villages and towns without migrating.[3] Along with the stimulus that roads may give to agricultural production and incomes, such improved access might well deter outmigration. In contrast, rural arterials, as suggested above, in radically reducing the effective distance between countryside and town, might increase migration because commuting would be impossible over the larger distances involved.

Many consequences of roads on migration are indirect. For example, Airey suggests that by encouraging schools roads may also encourage outmigration (since migrants tend to have more education).[4]

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[1]John Connell et al., Migration from Rural Areas. Delhi: Oxford University Press, 1976).

[2]Ibid., p. 77

[3]Okada, "Padat Karya Project."

[4]Patrick et al., "Sierra Leone/CARE Feeder Roads."

Intra-regional movements in search of greater economic opportunity may also be facilitated by improvements in village and regional rural access. Evidence on this point comes from the Padat Karya Project in Indonesia, where significant (10 percent plus) intra-village household movements in seven of 36 areas surveyed were noted, and lesser amounts in nine other areas.[1] However, no reasons for this were given.

Where governments build penetration roads linking overpopulated areas with undeveloped areas, there is likely to be a shift of population, as has occurred in Bolivia, Borneo, Brazil, Colombia, El Salvador, Nepal, Peru, Sabah and Somalia. The impacts on both the area the road opens up and the areas from which migrants originate should be taken into account. In the latter, it relieves population pressure, in the former it opens neglected areas to urban influences and results in imbalanced sex ratios.[2] Good roads into resource-rich areas are quickly taken advantage of.[3]

Transportation is both a cause and a consequence of population growth (due to immigration).[4] Smith found the following associations

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[1]Okada, "Padat Karya Project."

[2]Edmund Edward Hegen, Highways into the Upper Amazon Basin, Pioneer Lands in Southern Colombia, Ecuador and Northern Peru. (Gainesville: University of Florida Press, 1966.)

[3]Wennergren and Whitaker, "Investment in Access Roads."

[4]Wilson et al., Highway Investment.

in Uganda:[1]

	Terego	Madi	Jonam
increased road mileage (1946-56)	0	200%	400%
increased population (1948-55)	12%	22%	70%

In the medium term, access change is more likely to encourage migration into a remote area than outmigration, but this may be reversed in the long term.[2] In Thailand, not only did immigration double after the building of a road, but reasons for coming were primarily to obtain land rather than to join relatives. The same was true in Malaysia.[3] This led to increases in land values and transactions. A few entrepreneurs attracted by land can have significant influence on the introduction of new crops or production techniques and in socio-economic linkages with the outside. Berger found little evidence to support the idea that roads encouraged rural-urban migration, but the areas studied did not have significant "push" factors. Medium- and long-distance travel was unaffected, but local travel increased.

Blair found that the population of a road area declined by 20.6 percent (versus a control area decline of 16.5 percent.)[4] Within this area, population of villages within a mile of the road increased

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[1]Wilson et al., Highway Investment.

[2]Berger, "Transport Investment."

[3]Hughes in Haefele, Transport and National Goals.

[4]Blair, "Highway in Sierra Leone."

by 17.6 percent (23.8 percent for females and 12.0 percent for males) while in villages further away it decreased by 25.6 percent. Apparently, young men are going out of the area, and young women (wives) move to the road villages. One result is a lack of farm labor which prevents improvements in agricultural production. In this case, roads have not paid off.

Ellis et al. found no correlation between access in Liberia and emigration of employable population.[1]

Personal mobility is perhaps the greatest perceived benefit of roads for all income levels.[2] This mobility affects different ethnic groups differently. For the Ngoni or Chewa of Malawi who have a history of migratory flows, roads will have little effect. But for the Mende of Sierra Leone, roads can change perceptions and encourage a flow of people into towns.[3]

F. Social Change

1. National integration

The relationship between improved roads and communications is complex. The bringing of isolated communities into contact with a national culture is the expressed goal of many rural road programs. "Social roads" in Mexico are specifically aimed at the least developed and most remote areas in order to get these villagers to identify with

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[1] Ellis et al., "Liberian Rural Roads."

[2] Blair, "Highway in Sierra Leone;" Mitchell and Rakotonirina, "Andapa-Sambava Road;" USAID, "Philippines Evaluation."

[3] Hine, "Rural 'Feeder' Roads," in Transport Planning.

a larger region and the national culture.[1] Postal service, periodicals and personal contacts made possible by roads provides more information and information which is more timely, more reliable, and from more sources. This allows villagers to take advantage of opportunities they otherwise would not have had.[2] The availability of government services and political awareness also improve with better roads.[3]

2. Community development

Roads may also help in increasing the sense of community and improve community infra-structure. Communities often take the initiative of building roads themselves, as with Chan Kom, where the first earth track was called "the road to the light," a conscious attempt to direct the community towards progress.[4] In Mexico, the active participation of the community in selecting, planning, building, and maintaining roads increases its strength.[5] In the Mekong Delta, there was a clear felt need to maintain local roads.[6]

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[1] Johnson and Steiner, "Evaluating Social Roads."

[2] Owen, Distance and Development; USAID, "Philippine Evaluation."

[3] USAID, "Philippine Evaluation."

[4] Robert Redfield, A Village That Chose Progress. (Chicago; University of Chicago Press, 1950).

[5] Carnemark, "Mexico."

[6] Robert L. Sansom, The Economics of Insurgency in the Mekong Delta of Vietnam, (Cambridge; MIT Press, 1970).

Following the opening of roads, communities built community halls, mosques, adult education centers and libraries.[1] In Sierra Leone, roads were followed by new mosques, a rice mill, new concrete meeting halls.[2] Concrete construction would not have been feasible without the road, which allowed the importation of materials and a cement mason. A World Bank study of labor and capital substitution shows that in Honduras, the community obtained a water system from the government, built a small dam for irrigation and fish breeding and built a central square. Municipal taxes may increase as a result of a road's economic impact.[3] A World Bank consultant discovered instances where local road engineers, on their own initiative, had helped villagers organize for cooperative transport purchase.

Labor-based construction seemed, at least in three cases, to have significant benefits in terms of promoting increased and more regular positive contact between village and government. In one case, not only did the access roads facilitate a faster government response to emergency situations, such as floods, fires, epidemics, or crop infestations, but each successful subproject itself appeared to be a "medium of communication" between villagers and officials, "overcoming a sense of neglect or isolation which some villagers have felt

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[1]Hughes in Haefele, Transport and National Goals.

[2]Patrick et al., "Sierra Lone/CARE Feeder Roads."

[3]ROCAP, "Three Integration Roads."

in the past."[1] The project also provided a stimulus for further effort by both village and government. In one case, additional road network segments were constructed by village efforts, and government services and projects "have come more quickly given the improved accessibility which allows construction materials to be carried into remote areas."[2] The experience gained emboldened villagers to request more from the government, gave officials greater confidence and skills in management, and provided a "slow catalyst" to other villages. In another case, young people from small rural communities supervised the construction of secondary access roads to their towns and then assumed responsibility for their maintenance.[3]

Road construction, in the eyes of the beneficiaries, often appeared as a catalyst to government entities as well. In Indonesia and Mexico, introduction of roads was quickly followed by additional government services--electricity, potable water and extension services in the Yucatan; schools, roads, canals, and bridges in the case of Padat Karya. Whether the roads did indeed contribute causally to these further improvements or not, their correlation is undeniably perceived by

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[1]Okada, "Padat Karya Project."

[2]Foreign Economic Development Service, Improving Marketing Services.

[3]Okada, "Padat Karya Project"

the villagers as being causally linked.[1]

3. Impact on minority groups

In previously isolated areas, roads can threaten ethnic integrity, bring about deculturation or actually eradicate entire ethnic groups.[2] Davis believes that better road planning could have averted the disastrous effects on Brazil's Indians.[3] Instead, roads brought alcoholism, prostitution, begging, dispossession of land, malnutrition, epidemics, and cultural disintegration. Although Davis is writing of highways, low-volume rural roads contributed to these effects as part of larger road networks. A similar process is occurring in Colombia's Amazon region. There, rural penetration roads have brought immigrating peasants and Indian groups into conflict.

> The poverty of the Sierra drives the Campesinos to the lowlands, prompting a conflict between colono and indigena, White poor and Red poor. [Indians in areas further east, beyond the reach of the penetration roads,] were thankful for the lack of a road connection to the Sierra, which left a barrier to colono incursion and gave time to organize.[4]

In India, another author reported similarly negative but less radical results.

> Development of transport without corresponding development of protective measures has exposed the tribal economy to

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[1] Okada, "Padat Karya Project."

[2] Edwin Brooks, "The Brazilian Road to Ethnocide," Contemporary Review 224, 1974.

[3] Davis, Victims of the Miracle.

[4] Ibid.

> external forces over which the aboriginals have no control. It has shaken the self-sufficient economy of the aboriginal and shaken the very basis of aboriginal household crafts. Money has become the vital link between product and exchange. Advent of money exchange without its other concomitants, namely, measures of social security and state regulations, has exposed the tribal life to economic fluctuations and exploitation by more resourceful and better organized sectors of the society... such exploitation includes profiteering, exorbitant interest, fraudulent practices, corruption and bribery among government staff.1

Thus, it is not surprising that some local people do not want road improvements, in order to maintain their traditional culture, and that they exhibit passive or violent action in opposition.[2] Shooting up road crews to stop roads in Tak and Nam (Thailand) was as least partially a response of minority ethnic groups who felt roads would bring increased Thai administrative, police and tax control and threaten their economy (partly based on opium cultivation) and cultures.[3]

However, anywhere that minority groups control commerce and business, they can benefit disproportionately from road improvements (See Distribution of Benefits section.)

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[1]Prakesh Chandra Tripathi, Rural Transport and Economic Development. (Delhi; Sultán Chand, 1971.)

[2]Robert Bunker and John Adair, The First Look at Strangers. (New Brunswick; Rutgers University Press, 1959.)

[3]Arnold Abrams, "Thailand's 'Death Road', The Asia Magazine 26, 1974; Robert M. Hearn, "How the Hilltribes were Overlooked," Bangkok Post Sunday Magazine, Dec. 9, 1973; Aroon Larnlue, "Death Highway" Bangkok Post, Aug. 5, 1973; John McBeth, "Four Years of Blood, Sweat and Fears," Bangkok Post Sunday Magazine, Dec. 9, 1973.

4. Community values

National integration and wider communications patterns may also lead to new values. Visits to beauticians and cinemas, access to traveling theater groups, and rendezvous with ice cream vans may be minor events taken in isolation, but the cumulative result is a change in lifestyle.[1] The action of building a road may in itself lead to a new sense of conquering nature.[2] New contacts with the world outside the village leads to an enlarged world view and increased interest and understanding of new institutions, services and technologies. A World Bank study shows that those parts of the Yucatan undergoing rural development, at least, people feel an increased ability to control their future.

In one sense, however, a traditional rural culture is not unlike a minority group. A traditional way of life is often threatened by the changes associated with the introduction of road transport. Access to ideas, services, and consumer goods can be liberating, yet full of temptation and pitfalls. This issue certainly requires greater research, because the literature is extremely thin. Several authors note adverse social effects following the introduction of roads, including the deterioration of cultural values in areas of the Philippines,

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[1] Hughes in Haefele, Transport and National Goals.

[2] Okada, "Padat Karya Project", Thompson, French Indo-China.

increased thievery and teenage rowdyism in Thailand and Sierra Leone, and more traffic accidents.[1]

5. Impact on women

The most detailed investigation of the impact of a rural road on the social role of women was done by the World Bank and Mary Elmendorf in the Yucatan.[2] They found that women were more willing to modify their traditional behavior than men were, especially in such areas as education and the use of birth control devices. Young women, particularly, view the road as liberating, giving them more flexibility in establishing economic independence and defining new lifestyles. When the road opened in 1971, women requested a craft cooperative, sought out information about market conditions, and even began traveling alone. The road also affected marriage patterns and family structure. Pressures to marry at an early age decreased dramatically for women. In 1970 (as in 1930), there was only one unmarried woman over 18 in the village; by 1976, 10 of 12 women between 17 and 22 were unmarried--and no anxiety was shown by them or their parents. Decisions concerning age of marriage, selection of mate and number of children are now up to the young themselves. Women in their twenties have lost traditional constraints against

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[1] Berger, "Transport Investment; Blair, "Highway in Sierra Leone."

[2] Mary Elmendorf, Nine Mayan Women. (New York; Schenkman, 1976.)

going about without chaperones, modern dancing or the use of birth control pills. Family structure has changed from a joint family to what Elmendorf calls a "share family," one in which there is cooperation between autonomous production units and separate consumption patterns except for the basic self-produced food items (maize and beans). New employment opportunities allow individuals to leave the village, but no one is willing to break family ties; they send money home so as to maintain their membership in the family and ejido.

> Hence, roles are being redefined as women leave the village for employment opportunities and delay marriage. Despite the fact that they are employed in low-paying service capacities, they are experiencing a personal feeling of importance. Their new roles and status are accepted by their traditional parents partially because they are all regularly remitting funds to the household economy - a strong incentive - and are maintaining close social ties with home and family. And the road and accompanying bus service facilitates the continuing communication between parents and children.[1]

Only one girl between 17 and 22 has more than three years schooling, but now four girls are studying outside Chan Kom. Women still get less education, especially after menses, because of opposition to co-educational classes and of girls being away from home.[2]

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[1] World Bank study of socio-economic impacts of rural development in the Yucatan.

[2] Ibid.

A comparative study was conducted in two areas in the Philippines to determine the impact of infrastructure projects, especially rural roads construction, on the gainful economic activity of women.[1] It concluded that all sectors of economic activity (i.e., traditional, bazaar, modern) were positively affected by the project. The economic activity of the women depended upon a number of related variables, including education levels and opportunities, access to health services, child care, availability of credit, and business opportunities, among others.

Educational opportunities are correlated with roads and development. A comparison between the project and control areas showed that in each area daughters completed about two more years of education than had their mothers, and that the daughters from the control group had an equal amount of education (6.6 years) to the mothers in the project area, which was 2 years less than the daughters in the improved infrastructure area (8.52 years). Young women of the project area are benefiting from significantly increased educational levels and thus overcoming one of the major barriers to their participation in business activities. The project area demonstrated that increased health benefits and access to extension services also accompanied the infrastructure improvement. Infant mortality decreased, use of family planning

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[1] Beverly H. Hackenberg, "Impact of Infrastructure on the Changing Economic Lives of Women in Southeast Mindanao." (Davao City, Phil.: Davao Research and Planning Foundation, Inc., 1978.)

increased as did utilization of health services by the project area women.

The study found that modern sector employment, with the expected higher income, was generated as well as a lesser increase in earnings in bazaar and traditional commerce as a result of infrastructure improvement. Women's participation is increasing in all sectors due to the availability of services and inputs as mentioned above. It is primarily the younger women moving into the modern sector activities, and they, along with the next generation, will reap the greatest benefits from the improved infrastructure and the resultant changes.

Roads in some instances facilitate access to school for both women teachers and girl pupils.[1]

Elsewhere, too, changes in marketing patterns brought about by improved roads have been shown to be related to choice of marriage partners: a widening of economic relations allows women a greater potential pool of mates.[2]

In areas where women are market vendors, roads may well benefit them, providing them with a wider market area and more alternative marketplaces.

However, a shift from traditional peasant economy to cash cropping usually excludes women from many of the new opportunities in marketing

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[1] Owen, Distance and Development; Ward, The Rigo Road.

[2] Lawrence Crissman, "Spatial Aspects of Marriage Patterns as Influenced by Marketing Behavior in West Central Taiwan," in Carol A. Smith, ed., Regional Analysis, (New York, Academic Press, 1976).

or production, unless there are specific programs to retrain them or the availability of credit opportunities.

In Liberia, Ellis et al. suggests that the average family size and percentage of females increases with access (independently of migration).[1] This would seem to contradict Elmendorf's findings, where roads had introduced birth control and allowed women to leave the village. The Liberian situation may be a result of better medical care and improved living conditions, since more women may die of childbirth in isolated areas.

G. Environmental Impacts

Environmental considerations loom potentially large in analyzing the impact of rural roads, yet there has been little study devoted to these areas. Again, a distinction must be made between the impact of the larger penetration roads in unsettled areas and the impact of low-volume rural roads. Penetration roads, by opening new areas to settlement, have led to development of land for agricultural purposes, introducing two threats - deforestation and poor soil management in an ecologically unfamiliar zone. In the Nepal terai, new immigrants following the penetration roads are clearing the forest, a valuable and scarce resource, and engaging in confrontation with, and corruption of, local authorities.[2] Low-volume rural roads may lead to increased

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[1] Ellis et al., "Liberia Rural Roads."

[2] Blaikie et al., "Effects of Roads in Nepal."

density of settlement and use of land, thereby facilitating deforestation as well.

Exploitation of timber, firewood and charcoal often accompanies road building in the Philippines, Thailand, Malaysia, Haiti, Kenya and Sierra Leone.[1] This may temporarily increase income for some poor, but deforestation leads to problems of erosion, siltation and lowering of the water table.[2] Aymara and Quechua Indians moving into the lowland Yungas of Bolivia bring with them customs not well adapted to their new environment; for example, planting on steep slopes has more drastic effects in the Yungas than in the highlands.[3]

Road building associated with agricultural and mining activities in Amazonia leads to a change from primary tree species to bush and secondary species. A tropical rain forest is a canopy that protects the soil from erosion and solar reduction, functions to capture and store nutrients and thereby counteracts poor climatic and edaphic conditions. The conversion of rain forest to savannah results in leaching and erosion of soil.[4] Brazil has already partly abandoned plans to turn Amazonia into a giant cattle ranch primarily because of the environmental impacts such activity would engender.

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[1]Berger, "Transport Investment;" Benge in Hoskins-Western-Sonderegger, "Haiti;" Brokensha et al., "Kenya Rural Roads;" Blair, "Highway in S.L."

[2]Patrick et al., "Sierra Leone/CARE Feeder Roads."

[3]Milton in Farvar and Milton, The Careless Technology.

[4]R.J.A. Goodland and H.S. Irwin, Amazon Jungle: Green Hell to Red Desert. (Amsterdam; Mouton, 1975).

Because roads are usually built where it is cheapest to do so, they often pass through areas of high susceptibility to erosion and loss of soil nutrients as colonization exposes the soil to rain and high temperatures.[1]

In Sierra Leone, Patrick et al. suggest that, villages on roads are more likely to shorten fallow periods, and to drain and use swamps because of faster population growth, thereby depleting the soil and eliminating wildlife preserves.[2] Over time and as a result of the cumulative impact of road networks, wildlife, especially endangered species, can be affected as evident in many parts of Africa and Asia.

Flooding due to inadequate culverts is a problem in Thailand.[3] The cumulative impact of many small projects may be environmentally damaging. Roads in wetlands must pay particular attention to cross-drainage lest timber on the upper side of the road be drowned.[4] Dust due to roads is perceived as a problem in Thailand.[5]

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[1]Milton in Farvar and Milton, The Careless Technology.

[2]Patrick et al., "Sierra Leone/CARE Feeder Roads."

[3]Berger, "Transport Investment."

[4]Joseph H. Stoecheler, "Drainage along Swamp Forest Roads," Journal of Forestry 63, 1965.

[5]Berger, "Transport Investment."

III. CONCLUSIONS, ISSUES AND IMPLICATIONS

A. Introduction

This chapter briefly summarizes significant areas of agreement and disagreement found in the literature, and on the basis of the findings, develops specific "working questions" for AID. These queries suggest issues and impact areas that might be investigated by PPC/E's ex-post impact study of rural roads projects. The kinds of evidence necessary to resolve such issues and better understand certain impacts of rural roads are also pointed out for most of the issues raised. Much of this evidence can be obtained from rapid field visits, especially if good baseline data is available. If baseline data has not been developed for a project or is incomplete, both of which are common, trend data will provide the necessary information in some cases. If neither type of data is available, post-project field work will depend upon the recollection of interviewees, project preparation documents and other less reliable sources to obtain the necessary evidence.

The hypotheses and questions included are derived, for the most part, from the impact literature. Issues which the literature (i.e., recorded experience) does not deal with in one way or the other, however, have been included in the analysis when it was apparent they were or could be important in evaluating rural road projects.

Roads are implicit to rural development, but they constitute only one variable among many necessary for the integrated development of an area. Other significant political, economic, social and environmental factors exist, and they, together with infrastructure development, interact to yield the many impacts identified in this paper. Any examination of rural road impacts must somehow account for these other influencing factors, and thus, be location-specific as each area has its own unique blend of such factors.

The literature on the socio-economic and environmental impacts of low-volume rural roads raises several overall questions.

What complementary programs or adaptation of road projects are required in order to benefit, or minimize negative impacts of roads upon the poorest of the population?

1). To what degree and in what ways do the benefits or negative impacts associated with roads affect specific groups or classes in the project area?

2). What location-specific conditions affect such distribution of benefits?

What role do rural roads play in the economic development of rural areas?

What non-economic benefits and costs do rural roads incur, such as in the area of education and health, national integration and physical mobility, individual, family and community values, and environment?

Not all these questions are fully answered; in some cases, only very tentative or suggestive evidence is presented. However, the literature clearly indicates that economic measures, such as production, income and consumption, are insufficient to adequately

assess the influence of rural roads on the rural poor. Some knowledge is necessary also of the local distribution of benefits and costs; the impacts on community, family, social structures and values, including the role of women, and the impact on the rural environment.

For the section below, this report uses the following schema. Areas of agreement in the literature concerning impacts are briefly summarized by category, indicating what group is affected and the mechanism(s) by which such influence is felt. Areas of ambiguity ("what we don't know") are then raised as issues, first in general and then in specific terms. Lastly, the report suggests evidence that might be sought on AID project visits to resolve the general and specific issues raised as questions.

Of course, evidence collection, like project evaluation, is also location- and project-specific. The nature and availability of data differs from country to country and from project to project, depending on the amount of baseline data gathered, follow-up, the amount and accuracy of country statistical information, etc. The types of evidence desired to shed light on the impacts will differ depending on the specific project outcome. In some cases, as where roads have been in place for several years or more prior to evaluation, it may be possible to assess longer-term impacts, whereas for more recently implemented projects, consideration would be limited to short-term impacts. Thus, each suggestion for evidence collection is a general indicator, and will have to be adapted to the specific situation and data availability.

B. Impact categories

1. Agricultural production and crop composition

The current consensus is that rural roads should be evaluated primarily in terms of increased production, especially agricultural production. From a theoretical standpoint there is little that is not known about the relationships between roads and agricultural production, inasmuch as production effects have been the traditional measures of rural road influence and rural development.

a. Impacts

Not surprisingly, roads almost invariably lead to at least some agricultural production increases. The reasons are several, predictable and well understood. Roads are most efficient in stimulating agricultural production where:

- complementary inputs (market information, fertilizer and farm implements, extension services, credit, etc.) are provided;
- the majority of population did not previously live close to roads;
- transport is competitive;
- and cost of transport of agricultural produce is high as percentage of price (e.g. "heavy" produce like sugar cane) or where produce is highly perishable (e.g. fruit, vegetables, dairy products).

While most farmers are able to benefit from the introduction of roads, it is generally the larger, wealthier farmers who benefit most.

They are the most likely and able to take advantage of new inputs, possessing the attitudes, capital and risk-bearing capacity conducive to investment in increased production.

Roads change crop composition by providing a physical nexus between the farmer and the market, permitting the market to influence the kinds and proportions of crops grown, and enabling the farmer to respond to market opportunities. In line with common wisdom, subsistence farming generally gives way to commercial farming, especially on land closer to roads and markets. Numerous non-economic variables (e.g., "traditional" values, national power relationships) influence the rate and extent of the switch to commercial farming. The major variables in determining which cash crops are produced are perishability and the relative magnitude of transport cost savings. Production of crops which are perishable and require speedy marketing, such as fruit and vegetables, and/or which are transport-intensive (i.e., where the expenditure represented by transport is large relative to other costs), such as sugar cane, generally increase the most following the construction of a road and the consequent lowering of transport time and costs.

Once again, however, it is the smaller, poorer farmers who are least able or least willing to make the switch to commercial farming. Often the participation in the market by these farmers is partial, a significant portion of their production being withheld for house-

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hold consumption. Whether this is to their advantage or not is an issue upon which no consensus exists in the literature (see second issue in b. below).

b. Issues

In evaluating the production and crop composition impact of roads, four major groups of location-specific questions often arise:

- If road improvements were made but small or no measurable changes in agricultural output or crop composition were noted, what were the major constraints? Productive potential? Inadequate technology? Inadequate investment? Organizational shortcomings? Motivational deficiencies (i.e., "traditional values")? Does the indigenous productive structure (e.g. land tenure, population density, technology, etc.) resist increased productivity or marketing of produce? What market factors (e.g., elasticity of demand for agricultural produce, existence of transport monopolies, regulated agricultural prices, etc.) intervene to inhibit increased production and participation in the market?

  Evidence would include:

  — actual crop and livestock yield data in the area as compared to potential yield data from demonstration plots or the most successful farmers in the area;

  -- types of technology adapted to the area (pesticides, crop rotation, seed varieties, etc.) in comparison with the types of technology actually used by farmers;

  — credit terms, availability and requirements for various crop and livestock operations and the actual use of such credit by farmers;

  — market information available to farmers and the degree to which it is acted upon;

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— prices received for crops and livestock as compared to production costs; and

-- existence and conduct of input supply, transport and marketing institutions and the degree of knowledge farmers have of such conduct.

- Were the poorest farmers able to boost their production and make the switch to cash cropping? Does the road network reach the majority of farmers in the area, or is the zone of influence limited, leaving more distant farmers unaffected and marginal?

  Evidence would include comparison of past output levels with present output levels, past crop and livestock composition with present composition and past cash sales with present cash sales. Evidence regarding the zone of influence of the road could be determined by reviewing output levels, crop and livestock composition, cash sales, use of off-farm inputs, etc. as a function of each farmer's distance from the road.

- Were the changes in agricultural output or crop composition that did occur beneficial to low-income people? Did their productivity and income rise? Was their nutrition affected? Did they become subject to more or less economic risk as a result of the changes? If more risk, how can they minimize these risks?

  Evidence would include comparison of past productivity, income and nutritional levels with present levels for target group low-income people. Economic risk could be assessed by determining the extent to which more cash and off-farm inputs are required, the dependability and stability of the supply and price of such inputs, changes in the number of enterprises that farmers depend upon for their livelihood, the vulnerability of such enterprises to variability in yield, market availability and price, and the net income margin over time realized by the new enterprise mix.

- If major changes in agricultural output or crop composition did occur, was the road improvement a sufficient catalyst to cause the changes or were they due to the effect of other improvements as well? What complementary action and investment programs would have resulted in higher development impact?

  Evidence would include identification and description

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of programs or inputs (other than the road) that affected agricultural output or crop composition. The magnitude of the economic impacts of the road compared with the apparent economic impacts of other programs on various enterprises could be developed and reviewed. Related effects of both the road and other programs (such as information flows, availability of inputs, competition among traders, changes in values, etc.) could also be analyzed.

2. Technology

a. Impacts

In virtually every case examined rural roads played a significant role in expanding the use of new agricultural tools, machines, fertilizers, pesticides and new modes of transportation. Rural roads made these inputs more accessible and more reliable in delivery, which are important considerations for agricultural activities. Roads also increased the awareness of new technologies. While few studies attempted to identify the specific individuals or subgroups who benefited, those few that did made it clear that it was only the wealthier producers who could afford the often expensive and novel technologies. In the absence of complementary development programs, the net effect of the road and technology was to aggravate income disparities.

b. Issues

- What new technologies does a road make available? How do low-income farmers benefit from these in comparison with wealthy farmers? Can technologies only be utilized by the poor with the assistance of complementary develop-

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ment programs? What programs would be necessary (most effective) in light of other impacts of roads and development?

Evidence would include identification of technologies available after the road that were not available before, analysis of the relation of the road to the introduction of the technology, and determination of the impact of the technology on the economic and social life of wealthier vs. low-income people in the project area. Identification of 1) any programs designed to assist in the utilization of such technology, and 2) any areas where such programs do not exist and the analysis of the differential impact of new technologies on low-income people would provide evidence of the need for and effectiveness of complementary programs.

- What has been the impact of the introduction of roads on local and national energy demand? Roads have been associated in the literature with the increased use of mechanical power, chemical fertilizer and firewood; do these developments significantly exacerbate energy and environmental deficiencies locally and nationally? What complementary inputs of appropriate energy technology might be introduced along with roads?

  Evidence would include pre- and post- energy utilization in the road project area (fertilizer, chemicals, petrol, fuelwood, etc.) whether from local sources or national or international sources.

3. Agricultural service institutions

   a. Impacts

Rural roads appear to encourage the establishment of governmental service facilities and private cooperatives and to facilitate visits by government agricultural extension agents by increasing accessibility to the region and increasing the effectiveness of demands of the local population. The major beneficiaries, however, appear to be the larger farmers who are best situated financially

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and psychologically to take advantage of extension advice and programs (seminars, workshops) which are often geared more toward their commercial interests. Marketing, credit and other cooperatives formed following the introduction of roads vary greatly in their class of membership, often directed toward or attracting relatively more advantaged farmers rather than those most in need of marketing, credit information and other services in responding to the opportunities provided by the new roads. Participation in cooperatives is a function of social structure and the existence of complementary development programs.

b. Issues

- To what degree do roads actually increase extension visits to and programs for smaller, poorer farmers? Are sufficient extension agents assigned to the area to respond to the needs stimulated by the new roads? Are extension programs designed with the small producer in mind, taking into account his lack of capital, his limited, often marginal and isolated land, and his common reluctance to bear risk?

  Evidence would include the number of visits to low-income farmers in the project area before and after the road is in place. Examination of the focus, budget, staff and formal and informal priorities of the local extension program would provide evidence regarding the responsiveness of the program to the needs of low-income farm families.

- Are the cooperatives that develop following the introduction of roads open to membership by smaller, poorer farmers?

Evidence would include the number of low-income farmers in such cooperatives, the membership and other requirements of such coops, and the degree to which such farmers are active in the cooperative leadership and activities.

4. Agro-industrial, industrial and commercial enterprises

a. Impacts

Agro-industrial, industrial and commercial enterprises increase along the road corridor as well as in communities newly serviced by the roads. Increased availability of raw materials, access to markets for finished products and reduced transportation costs encourage the expansion of agro-industrial and industrial facilities. Increased road traffic as well as availability of commercial goods stimulates the establishment of new commercial enterprises and retail establishments to respond to the growing consumer/traveller demand. Several studies, however, indicated that cottage industries suffered due to competition from cheap manufactured imports.

The literature reports instances where the new entrepreneurs are local residents as well as migrants from outside. Low-income people benefit from the enterprises through some increased employment and entrepreneurial opportunities and consumer goods availability.

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b. Issues

- How viable are the numerous small retail establishments set up in response to the opportunities following road construction? Are they part of a permanent or temporary surge of activity? What restrains their profitability (Lack of sufficient capital? Excessive competition? Uncertainty or fluctuation of clientele?)

  Evidence would include longitudinal financial, employment, sales and profit information for such enterprises, the number of firm openings and closings, the degree to which customers believe such enterprises meet their needs and the degree to which the target population patronizes such establishments.

- Are existing local cottage industries able to survive following the introduction of roads and subsequent greater availability of imported goods?

  Evidence would include trends in the number of area residents working in this sector, the amount and percentage share of total income accruing to each participating household, and the quantity range of goods produced.

- Do the business activities that arise contribute to basic human needs, e.g., better nutrition, housing, agricultural activity, or to consumerism e.g., consumption of urban clothing, radios, "junk foods," etc.

  Evidence would include the purchases and consumption patterns of households before and after the introduction of such businesses and the stock turnover in such stores.

- Are the industrial and commercial activities that arise as a result of roads brought about by local people (from the area where the road is located) or are they extensions of business activities owned or controlled by persons who were originally located outside the zone of influence of the road?

  Evidence would be the geographical origin of the persons owning and managing such activities just prior to the establishment or take-over of each enterprise.

5. Employment

a. Impacts

Where labor-based road construction takes place, rural roads logically stimulate short-term employment of the area population, primarily among unskilled or semi-skilled males, but on occasion (where efforts are made) among women as well. Significant short-term employment is also created in construction-related activities, such as feeding and servicing the labor crews.

Roads tend to promote medium- and long-term employment by increasing the skills and subsequent employability of those who worked on road construction and maintenance by enabling commuting to nearby communities for casual paid work, and by stimulating regional production and commerce. Opportunities for women in handicrafts and vending have in some cases broadened. However, the displacement of porters, cart drivers and others engaged in traditional modes of transportation, together with more general disruption of the social and economic community structure, can encourage out-migration, particularly of young men, toward areas of greater employment opportunity. The manner in which these two opposing forces balance out in any particular area depends upon the specific "push" and "pull" factors which are operating.

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b. Issues

- While agricultural and non-agricultural industries and commerce do arise, are the numbers employed sufficient to make an impact on rural underemployment? Is employment in agriculture and cottage industries affected?

  Evidence would include the number of people in the sector unemployed or underemployed (both before, during and after the road project is implemented), data on out-and in-migration and seasonal migration for the project area, as well as information on changes in employment in the agricultural and industrial sectors in the project area after the road is introduced.

- What are the multiplier effects of road-generated short- and long-term employment and business activity increases?

  Evidence would include the amount of investment generated by both of the above activities and the additional employment and income generated in the project area by such investment. Calculation of marginal propensities to save and invest would be impractical, but indications of investment flows and employment and income levels over time could be used as a proxy for actually calculating the multiplier.

- Do roads increase female employment or not? In what areas or categories? Under what conditions and why? What complementary programs are required? How do local values and social/economic roles affect the road impact?

  Evidence would include the numbers of female persons employed in certain activities (whether for wages or not) before and after the road. Examination of any programs designed to enhance female employment (or that have such an effect) to determine their impact in conjunction with the road would also provide evidence. Local values regarding wage employment for women could also be determined and associated with the above evidence.

- How is it possible to identify beforehand what the employment impacts of a road will be? What determines those impacts: the solidity of the existing employment structure or outside influences brought in by the road?

  Evidence would include the number of local jobs that are deliberately designed into the road project, concrete plans for associated business activity, the availability of unemployed or underemployed labor with appropriate skills for such jobs, and the degree to which information about such jobs is or will be communicated to potential employees.

6. Land values, tenure and use

   a. Impacts

The introduction of low-volume rural roads leads to increased land values, more intensive land use and a greater number of land transactions, especially for land adjacent to the road. These changes are less marked for low-volume rural roads than in the case of rural arterial roads. Proximity to the road and the benefits and services which extend along its length become highly desirable following road construction, increasing the demand for and value of the land in direct proportion to its distance from the road. The effect often is increased rents and shifts in ownership and tenancy of land close to the road from poorer farmers or those without legal title to a wealthier entrepreneurial class. The latter group is most able to take advantage of the changes induced by the road. Settlement along the road increases, residential and commercial use increases, and sometimes entire communities relocate from more remote

areas. Land retained for agricultural use is generally put under more intensive cultivation, particularly of high-bulk and/or perishable cash crops which can be more profitably marketed owing to the improved and less expensive transport.

The few documented cases where shifts in ownership did not commonly occur were where land tenure was relatively open and equitable, where little land speculation existed due to the traditional high social value placed on land (and hence a reluctance to sell), and where specific development programs counteracted these tendencies.

b. Issues

- What are the long-term consequences of low-volume rural roads for land ownership and water rights? Under what conditions does displacement from land adjacent to the road occur? Does displacement increase the disparity between rich and poor and increase the number of landless in the region? These impacts could be expected to vary from area to area, depending on land tenure, title registration, social stratification and other variables.

  Evidence would include trends in land values, land turnover data and land use before and after the road, and the position of various economic classes in terms of land ownership, rental or use before and after the road project is implemented.

- Might a network of low-cost, low-volume farm-to-market trails reach more of the local population as well as have a lesser, more diffuse impact on land values and transactions, hence prompt less displacement? Would benefits be sufficient in this case? Or must complementary development programs, such as credit and extension, accompany road projects so as to offset the displacement effects?

Evidence would include comparative data on land values, transactions and use, income impacts and numbers of people affected--all by income category--in two areas, one where trails are developed and another where a road is implemented.

- Does the introduction of a rural road network in one area lead to decreased production and land values in nearby areas outside the road's direct area of influence?

  Evidence would include data on land value, use, turnover and registrations in areas outside the road's direct area of influence before and after the introduction of the road.

7. Transport costs

   a. Impacts

Improvements in road conditions usually lower transport costs by reducing time expenditures for travel, enabling use of motorized vehicles and encouraging competition among bus and trucking firms. Lower costs are enjoyed by all road users for passenger transport as well as freight movement but the purchase of new modes of transport are at times out of the economic reach of the poor. In some cases, middlemen or transport monopolies absorb the savings and do not pass them on to consumer and producer. However, if transport costs represent a small percentage of total product costs, any transport savings will usually have minimal impact on marketing and production activities. Thus, important variables to consider when assessing how roads affect specific productive and marketing behavior

include: (1) the distribution of savings among transporters, middlemen, consumers and producers; and (2) the absolute and relative importance of transport costs for the production or consumption of a commodity.

b. Issues

- Where actual transport savings are minimal, what is limiting the amount of savings in specific areas? Quality and/or quantity of transport facilities? Physical road deficiencies? The kinds of goods being marketed? Can new crops be introduced which might yield greater savings?

  Evidence would include data on the organization, conduct and performance of transport enterprises, the kind of goods being marketed, their profitability and markets, the information reaching farmers about market opportunities, and any government pricing policies affecting crop production, transport and marketing.

- If transport savings are realized but do not reach producers and consumers, where do they go? Do monopolies (middlemen or otherwise) absorb the savings? How can the barriers be eliminated?

  Evidence would include time series data on transport prices and profits of producers, transporters, middlemen and retailers.

8. Marketing patterns

a. Impacts

Marketing activities increase with the improvement of road systems, and marketing patterns adjust to easier access to market centers. The roads enable producers to travel more regularly to market or to send their goods to market as transport costs fall and

vehicle size increases. Goods also travel further out along the road network, reaching the previously isolated areas. Those farmers closest to the road and market generally tend to bypass the middleman, performing the market function themselves, in order to realize higher income. Low-volume marketing activities tend to increase alongside the road, often increasing the role of women. For those producers at the opposite end of the road corridor from the market, however, several studies suggested that the role of middlemen increased and that the point of sale actually moved closer to the point of production. Such a development was attributed to increased ease in traveling further from the market center and increased competition among middlemen who had lost their audience closer to market, and sought out the producers further away. In any case, the largest beneficiaries of increased farmer marketing activity are the large cash crop producers and those close to the market center, although marketing activities for the small farmers also rose.

b. Issues

- What is the degree of middlemen activity - has it increased or decreased? At what points? What impact has this had on other marketing patterns? Does the point of sale move further from or closer to the place of production?

Evidence would include trends in the number of middlemen, transactions by middlemen and number of customers per middleman.

- What increased marketing activities are taken up by various families according to their place on the income scale? Do poor farmers tend to vertically integrate as compared to wealthier farmers? Do members of the family, such as women, begin to sell items such as foods in market centers?

  Evidence would include marketing activities (defined by type, volume, frequency, etc.) undertaken before and after the introduction of the road as a function of family income level.

9. Consumption patterns

   a. Impacts

Almost all studies examined note an increase in consumer goods, social travel and recreational activities following the construction of rural roads as the money economy penetrates the area and travel time and distance decreases. Roads encourage the introduction of imported goods and values (i.e., consumerism) in previously isolated areas by raising incomes, lowering transport costs and increasing contact with urban areas. Benefits from roads, however, are not evenly distributed, and the ability to increase consumption varies. Better-off rural inhabitants are more able to fulfill their new consumer needs/desires. The ability of the poor to participate in these new consumption patterns is often marginal, increasing their frustrations and/or diverting their consumption away from basic material and nutritional needs, toward superfluous desires. One clear

and nearly universal benefit, however, is the ability to travel more inexpensively for social and business purposes.

b. Issues

- Are the rural poor better off as a result of the road either in an absolute or relative sense? Are they able to benefit from increased consumption opportunities or are they excluded from consumerism by lack of funds? What programs could best increase equity in the distribution of benefits to women, the landless, and other identifiable segments of the rural poor?

  Evidence would include increases in consumption of various products (by income category) that can be most directly attributable to the road and which are beneficial from the consumers' point of view - e.g., radios, bicycles, metal roofing, prepared foods, stationery supplies, lanterns, woven baskets, fresh produce, etc. Analysis of reasons why some groups - e.g. the landless -- do not benefit absolutely or relative to others will provide evidence needed to design complementary programs to increase the distribution of road-induced benefits to such groups.

- Do roads stimulate imbalances between production and consumption levels? To what extent do imports for consumption purposes reduce the potential for savings and investment in production? What remedies, such as incentives to investment and measures to channel consumption toward local goods, are available?

  Evidence would include consumption, savings, and investment rates before and after implementation of the road project as well as an analysis of changes in consumption expenditures for non-local as compared to project-area-produced goods and services.

10. Health and nutrition

a. Impacts

Rural roads increase access to health centers and

specialists for routine health services as well as emergency assistance (which is frequently identified as one of the major benefits of roads). However, the literature is divided as to the degree to which people actually take advantage of the health services. Some authors also noted that access to health facilities may lead to an emphasis on curative medicine to the detriment of preventive measures such as a balanced diet or appropriate living conditions.

Provision of rural roads indirectly affects nutrition by encouraging change from subsistence to cash crop production. Family dependence for nutrition switches from the traditional home-grown diet to food purchased in retail outlets, which may not be of equal nutritional value, as has happened in several cases noted in the literature.

Roads, by encouraging mobility and mixture of peoples and goods, facilitate the spread of insect-borne and communicable diseases. This consequence of roads is not well understood or documented and it is difficult to observe, yet its impact can be devastating.

b. Issues

- Do the rural poor take advantage of the better access to health facilities made possible by rural roads and expanded transport systems? If not, how can their participation be encouraged? Which services would they be most likely to take advantage of? Are extension services adequate to encourage usage of health facilities? Do the facilities offer the services most needed and desired by rural residents?

Evidence would include frequency of the use of health facilities before and after a rural road is developed, by different income categories. The kind of services desired by residents in the project area and the kinds of services actually provided and their cost will provide evidence of why health facilities are used as they are by the residents.

- How common is it that nutrition levels fall following a road-induced switch from subsistence to commercial farming, and for whom? Are the goods available for sale conducive to a balanced diet? Is this diet affordable? Are people aware of nutritional requirements when buying food, i.e., do they follow their traditional consumption patterns or do they purchase new items the roads carried in, potentially less nutritional than what they are used to?

  Evidence includes dietary patterns by family income category before and after the introduction of a road and their relation to sound nutritional requirements. Examination of the mix of food products available for consumption and their price in relation to various family income levels would provide evidence about whether the products available to consumers are conducive to a balanced diet.

- What are the best means of forecasting health hazards which might accompany roads, and how can the roads be designed to avert them?

  Evidence would include determination and analysis of the geographic conditions in the road project area (swamps, etc.) and of existing indigenous pests and diseases that might be transmitted by road activity.

11. Education

a. Impacts

The impact of rural roads on education is not clear-cut. On the one hand, roads facilitate access for both teachers and pupils.

On the other hand, if no programs exist to open new schools or expand enrollments, roads by themselves will have few consequences. Educational improvements, such as a rise in literacy rates or grade level attained, are long-term phenomena and in general have not been the object of study in road evaluation projects.

b. Issues

- Do roads improve access to education? In what way: by bringing rural children to village schools, or by enabling teachers to commute to more isolated rural schools? For whom: do the poor or the better-off families benefit more?

  Evidence would include the number of students by family income category attending school before and after the road is introduced, the time spent travelling to and from school by students and teachers, the introduction of new schools, different means of transport to and from school, and the duration of school attendance by students.

12. National integration

a. Impacts

Rural roads, by extending access, increase national integration. This may be a benefit from the point of view of a society seeking national development, but at the local level whether this is a benefit or not will depend upon the effect on ethnic identity, income distribution, power distribution and family and local community relationships.

b. Issues

- What are the effects of rural roads on power exploitative relations? How do roads intensify these and what complementary programs might counteract them?

  Evidence would include identification of changes in wealth, social or political status among families or individuals as a result of the road and the effects of such changes upon lifestyle, income, economic and social security, existing institutions and traditional practices of different groups in the project area.

- What impact do rural roads have on the issues of local or tribal identity vs. national identity and local authority (e.g., chief) vs. national authority (e.g., police)?

  Evidence would include presence of schools, police posts and other government activities, incidence of out-migration (especially to urban areas), percentage of local population able to speak the national language, and local attitudes as revealed through surveys.

13. Community and family structure

a. Impacts

In some cases, at least, by giving access to new employment opportunities and individual economic independence, rural roads may contribute to the break-up of the household as a production and consumption unit. To the extent that low-volume rural roads strengthen agricultural production, however, they may also strengthen the peasant household.

The same opposing forces work at the community level. To the extent that roads reorient activity and stimulate migration, they

weaken the "little community." But to the extent that they stimulate production, increase local opportunities and increase government services, they may strengthen community structure.

In addition to the economic potential, a key factor seems to be the extent to which the community is mobilized as a unit in the planning, construction and maintenance of the roads.

b. Issues

- Under what circumstances will community and family structure react adversely to road projects?

  Evidence would include data on changes in permanent and seasonal migration, divorce or separation, births per family, community social activities, events and organizations, local governance, frequency of visits to or from other communities, etc. and an analysis of the pros and cons of such impacts on community and family structure.

14. Values

a. Impacts

As a link to the larger society, low-volume rural roads contribute to a shift from a peasant world view to a modern world view. Particularly for those who are able to take advantage of marketing opportunities and government services (e.g., the relatively better-off, more ambitious, etc.), this includes a greater sense of control over the future and over the environment, and participation in a national culture with greater government-village interaction.

Urban values concerning the role of women penetrate the rural areas, generally leading to greater economic and social opportunity for that sex (see section on women below).

The changes induced by roads and the penetration of new values may not all be positive, however. As noted above in the section on consumption, the growth of consumerism following the introduction of roads can lead to inbalances between consumption and income, especially among the poor, as those with insufficient means attempt to initiate urban lifestyles. The frustrations coming out of this as well as the overall changes in rural society have led in many instances to manifestations of alienation, such as alcoholism and petty crime.

b. Issues

- Do existing values impede or facilitate the predicted impacts of rural roads, especially on the levels of agricultural production, crop composition and consumption of goods and services? Do significant portions of the population participate in activities made possible by the road?

  Evidence would include identification of existing values (statements containing nomative content such as "should" or "ought") and determination of the influence of such values on changes in agricultural production, crop composition, consumption patterns, etc. induced by the introduction of a road.

- What programs might be instituted to cushion the impact of the change from traditional to modern culture accompanying the introduction of roads especially in the case of politically and culturally oppressed minorities?

Evidence would include identification of the way in which such groups might be detrimentally impacted (e.g., loss of access to land, changes in sex roles, or introduction of disease) and developing interventions to accompany the road that will mitigate such impacts. Evidence as to appropriate interventions would be drawn from observation of the affected groups and from their views about what they value and would not like to see changed by exogenous forces introduced by the road.

15. Ethnic minorities

a. Impacts

Where ethnic minorities are power-poor, rural roads will have few benefits for them and, as in Amazonia, may lead to their decimation through the introduction of disease, alcoholism, outside land-grabbers and entrepreneurs intent on exploiting the situation.

b. Issues

- What is the influence of roads on ethnic relations and ethnic identity?

  Evidence would include statistics and data on population, lifestyle and participation of the ethnic group in the rural society.

16. Women

a. Impacts

What little the literature tells us does not bear out the assumption that roads generally have greater consequences for men, especially with regards to changes in employment and production,

than for women. The only in-depth study which sheds light on the subject found that women had changed most in obtaining new economic opportunities and in the ability to control their future, such as through the use of birth control and the delay of marriage.

The reasons for these changes appeared to be the economic impacts accompanying the road, which provided new opportunities, and the access and exposure to health services, information and urban values stemming from the increased communication stimulated by the road. The impact seemed to be spread uniformly across social classes, although relatively little social stratification existed in the area, and the women who changed were village inhabitants rather than isolated rural residents.

b. Issues

- Is there a conflict between the observed common social/structural liberation of women following road construction and the often limited economic opportunities afforded by generally male-oriented complementary programs?

  Evidence would include observation and analysis of womens' actions, activities, values and feelings following the introduction of a road and determination of their perceptions of their access (and their actual access) to employment and other opportunities made possible (usually to males) by the introduction of a road.

- In rural developing societies, market vendors are commonly women. Following road introduction, are these vendors displaced by large-scale merchants or do they take advantage of transport to expand their market areas?

Evidence includes the number of women involved in marketing activities before and after a road project and the extent of those activities in terms of volume, frequency, market power, and income potential.

17. Urbanization, dispersion and migration

a. Impacts

The spatial impact of low-volume rural roads is complex and area-specific. It is unclear whether roads encourage or discourage migration. The evidence suggests that low-volume rural roads strengthen nearby towns as administrative and economic centers, promoting commuting for permanent or short-term work from the surrounding area. In these cases, the direct, initial impact may be to discourage migration. In contrast, rural arterial roads, in radically reducing the physical and psychological distance between countryside and urban center, may increase migration. Inasmuch as roads facilitate education and the penetration of urban values, they may indirectly stimulate migration over the long term.

b. Issues

- Does the introduction of low-volume rural roads retard or encourage migration to urban areas and by whom? Do increased numbers of rural people commute to nearby villages? Are rural villages and towns strengthened as administrative and economic centers for the surrounding rural areas?

  Evidence would include government statistics on volume and origins of migration, local data concerning employment and community populations, and statistics on

employment and growth of the bureaucracy in villages and towns.

18. Environment

a. Impact

In spite of its importance, relatively little study has been given to the environmental impacts of rural road development. Generally, however, rural roads tend to accelerate deforestation as a result of the expansion of agricultural land and the exploitation of timber for firewood, charcoal and building lumber. Deforestation in turn leads to increased soil erosion, lowering of the water table, higher incidence of flooding and/or drought, and elimination of wildlife. Roads also lead to an intensification and extension of adjacent land use, leading to the shortening of fallow periods and deterioration of soil fertility. New inputs such as fertilizers and pesticides contribute to chemical pollution which may become significant over time. Poor road design has often led to flooding, erosion, timber damage and other environmental damage in the immediate vicinity of roads.

b. Issues

o Concomitant with road projects, can short-term benefits of forest exploitation be retained while environmental costs are controlled by forest management schemes?

Evidence would include determination of the short-term forest exploitation within sustainable yields that is

desired for environmental reasons and the management and control devices that would assure no more than the desired degree of exploitation. Data on population, wood energy usage, industrial timber and building pole requirements together with soil erosion qualities, forest regeneration capability, traditional practices regarding access to forest products, community level authority for controlling utilization of forest products, etc., would provide needed evidence.

- o Does the environmental impact of the development unleashed by the introduction on rural roads, inevitably lead to deterioration of farmland fertility and length of fallow cycle, and forest and swamp area vegetation and wildlife?

  Evidence would involve trends in forest exploitation, length of the fallow cycle and crop yields, areas in forest, swamp, and natural vegetation and wildlife population.

- o Has road design taken into account environmental factors and costs?

  Evidence would be the inclusion of adequate environmental analysis, and associated costs, in the project identification through evaluation stages. Such analysis would be location-specific, and would include consideration of forest, water, soil and wildlife quality and the costs associated with its deterioration or preservation.

C. Implications

Some of the broad implications of the above impacts and impact issues for planning factors such as institutional setting, road selection criteria, technical design issues, choice of construction technology, maintenance of roads, etc. are:

-- the development of rural road projects should be based as much upon social and environmental as upon economic factors;

-- the target group that a rural road project is to assist should be defined and understood in social, environmental and economic terms;

-- achieving the desired impact(s) of a rural road project is likely to depend as much upon complementary programs to maximize benefits and minimize negative impacts upon the target group as upon the direct results of the road project itself;

-- participation of the target group helps resolve many social and economic issues involved in rural road projects and helps maximize the desired impacts of projects on the target group;

-- adequate baseline information and longitudinal studies are required to fairly assess the specific impacts of rural road projects because such impacts take shape over relatively long time periods.

ANNEXES

ANNEX 1

BIBLIOGRAPHY*

Bibliographies

Coleman, D. J. Highways and the Environment: A Bibliography of the Effects of Highways on the Physical, Recreational and Aesthetic Environments and of Techniques for the Analysis of These Impacts. Exchange Bibliography 394. Monticello, IL: Council of Planning Librarians, 1973.

Hsu, Ann Yi-rong; and Wheeler, James O. A Bibliography of Highway Impact Studies, 1966-1976. Exchange Bibliography 1401. Monticello, IL: Council of Planning Librarians, 1977.

International Road Federation. 1978 World Survey of Current Research and Development on Roads and Road Transport. Washington: International Road Federation, 1978.

International Road Federation. Roads: Social, Economic and Financial Aspects - Summaries of Selected Papers. Washington: IRF, 1973.

Irwin, Lynne H. Transportation for Developing Countries, An Annotated Bibliography. Ithaca: Cornell University, 1975.

Skorpa, Lidvard; Dodge, Richard; Walton, Micheal C.; and Huddleston, John. Transportation Impact Studies: A Review with Emphasis on Rural Areas. Washington: Department of Transportation and Austin: University of Texas, 1974.

General Works

Abedi, Z. H., and Miller, Max J. "Roadside Tsetse Hazard in Liberia." American Journal of Tropical Medicine and Hygiene 13 (1964):499-504.

Abrams, Arnold. "Thailand's 'Death Road'." The Asia Magazine, 26 May 1974.

*Sensitive or controlled documents of the World Bank and other organizations were made available to the researchers of this study with the understanding that they would not be cited in an edition for the gneral public. These documents have been handled in this report in a manner consistent with the World Bank and other organizations' treatment of sensitive material.

Ahmed, Yusuf, O'Sullivan, Patrick, Sujono, Wilson, Derek Road Investment Programming for Developing Countries, An Indonesian Example. Evanston, IL.: The Transportation Center, Northwestern University, 1976.

Barlett, Peggy F. What Shall We Grow? A Critical Survey of the Literature on Farmer's Decision-Making. Prepared for Civic Participation Division, Bureau for Program and Policy Coordination, Agency for International Development. Washington, May 1978.

Barwell, I. J. and Howe, J.D.G.F. Appropriate Transport Facilities for the Rural Sector in Developing Countries. Geneva: The World Employment Program, Technology and Employment Branch, International Labour Organization, 1979.

Barwell, I. J. and Howe, J.D.G.F. "Appropriate Technology and Low Cost Transport." in Low-Volume Roads: Second International Conference. Transportation Research Record 702. Washington: National Academy of Sciences,1979.

Berger, Louis. "Getting the Farmer Out of the Mud." Worldwide Projects (April-May 1978).

Bowman, Isaiah. The Pioneer Fringe. Special Publication 13. New York: American Geographical Society, 1931.

Bracamonter, L. E. "Highway Requirements in Developing Countries-Mexico." Seventh IRF World Meeting, Munich: International Road Federation, 1975.

Braida, Richard L. et al. "The Role of AID in the Development of Sahel Transportation Infrastrucure, A Strategy Proposed by the Office of International Transportation Programs, U. S. Department of Transportation." (Draft). Washington: Department of Transportation, 1978.

Brooks, Edwin. "The Brazilian Road to Ethnocide." Contemporary Review 224 (May 1974):2-8.

Brunner, Charles. "The Economic Justification of Roads." The Institute of Highway Engineers, n.d.

Bunker, Robert and Adair, John. The First Look at Strangers. New Brunswick: Rutgers University Press, 1959.

Byl, Adhemar. "The World Bank Group and Rural Roads." Planning, Transport Planning and Highway Design in Developing Countries. London: Planning and Transport Research and Computation, 1977.

Chisholm, M. Rural Settlement and Land Use. London: Hutchinson University Library, 1962.

Connell, John, et al. Migration from Rural Areas: The Evidence from Village Studies. Delhi: Oxford University Press, 1976.

Crissman, Lawrence. "Spatial Aspects of Marriage Patterns As Influenced by Marketing Behavior in West Central Taiwan." Regional Analysis, Carol A.Smith, Ed. NY: Academic Press, 1976.

Davis, Shelton. Victims of the Miracle. Cambridge: Cambridge University Press, 1977.

De Beer, A. R. "The Economic Justification of Roads in Developing Countries." Road International 48 (1963): 30-35.

"Dossier: The Main African Road Projects." The Courier, No. 54, March - April 1979, pp. 56-84.

Edmonds, G. A. "Appropriate Technology for Low-Volume Roads." Low-Volume Roads: Second International Conference. Transportation Research Record 702. Washington: National Academy of Sciences, 1979.

Edwards, Chris. "Some Problems of Evaluating Investments in Rural Transport." In Transport Planning in the Developing Countries. London: Planning and Transport Research and Computation, 1978.

Elmendorf, Mary Lindsay. Nine Mayan Women, A Village Faces Changes. NY: Schenkman Publishing Co., 1976.

Farvar, M. Taghi, and Milton, John P., eds. The Careless Technology, Ecology and International Development. Garden City, NY: The Natural History Press, 1969.

Foster, George. Traditional Societies and Technological Change. NY: Harper & Row, 1973.

Fromm, Gary ed. Transport Investment and Economic Development Washington: The Brookings Institution, 1965.

Goodland, R. J. A., and Irwin, H. S. Amazon Jungle: Green Hell to Red Desert? Amsterdam: Mouton, 1975.

Gwilliam, K. M. "The Indirect Effects of Highway Investment." Regional Studies 4 (1970):167-76.

Haefele, Edwin T., ed. Transport and National Goals. Washington: The Brookings Insitution, 1969.

Hawkins, E. K. Roads and Road Transport in an Underdeveloped Country. London: Colonial Office, 1962.

Hearn, Robert M. "How the Hilltribes were Overlooked." Bangkok Post Sunday Magazine, 9 December 1973, pp. 14-15.

Hagen, Edmund Eduard. Highways into the Upper Amazon Basin, Pioneer Lands in Southern Colombia, Ecuador, and Northern Peru. Gainesville: University of Florida Press, 1966.

Howe, J. D. G. F., and Barwell, I. "Technology and Employment Programme: Equipment for Labour-Based Road Construction." World Employment Programme, Research Working Papers 40. Geneva: International Labour Organization, 1978.

Hoyle, Brian Steward. Transport and Development. London: Macmillan, 1973.

Hradsky, James A. "USAID Experience in Policy Formulation and Project Design in the Transport Sector of the Sahel: A Personal Opinion." (Draft), Washington: USAID 20 March 1978.

Jackson, Jean E. "Colombia: Instant Underdevelopment for Indigenous Tribes." ARC Newsletter 2 (1978):4-4.

Johnson, G. P. and Steiner, H. M. Evaluating Social Roads in Mexico." Journal of Transport Economics and Policy VII. 1 (1973):98-101

Jones, William I., ed. "Planning the Transport Sector: Road Building." Development Digest, July 1966, 4(2):1-40.

Khachaturov, T. S., and Wasilewski, L. I. "World Transportation Development: Ecological Aspects." High Speed Ground Transportation Journal 7.1 (1973): 37-46.

Kreisberg, Martin, and Steele, Howard. Improving Marketing Systems in Developing Countries: An Approach to Identifying Problems and Strengthening Technical Assistance. FEDS Staff Paper No. 7 Washington: Foreign Economic Development Service, U. S. Department of Agriculture, co-operating with the U. S. Agency for International Development, 1972.

Lal, Dupak. Men or Machines. Geneva: International Labour Organization, 1978.

Larnlue, Aroon. "Death Highway." Bangkok Post, 5 August 1973.

Larnlue, Aroon. "Terror Reigns Over Umphang." Bangkok Post, 17 September 1973.

Larnule, Aroon. "Tak Communist Roadblock." Bangkok Post, 23 September 1973.

Mannheim, Marvin L., Suhrbier, John H., Bennett, Elizabeth D., Neumann, Lance A., Colcord, Frank C. Jr., and Reno, Arlee T., Jr. Transportation Decision-Making, A Guide to Social and Environmental Considerations. National Cooperative Research Program Report 156. Washington: National Research Council, Transportation Research Board.

McBeth, John. "Four Years of Blood, Sweat and Fears." Bangkok Post Sunday Magazine, 9 December 1973, pp. 14-5.

McCleary, W. A. Equipment Versus Employment. Geneva: International Labour Organization, 1976.

Millard, R. S., and Bonney, R. S. P. "Road Transport in Developing Countries." Seventh IRF World Meeting, Munich: International Road Federation, 1975.

Moerman, Michael. Agricultural Change and Peasant Choice in a Thai Village. Berkeley: University of California Press, 1968.

Nelson, Michael. The Development of Tropical Lands: Policy Issues in Latin America. Baltimore: The Johns Hopkins University Press, 1973.

Odier, Lionel. The Economic Benefits of Road Construction and Improvements. Paris: UN, 1967.

Organization for Economic Cooperation and Development. Conference on Rural Road Transport Planning in Developing Countries (Paris, 15-16, Dec. 1977).

Organization for Economic Cooperation and Development. Summary Statement of the Joint Working Group on Rural Road Transport Planning in Developing Countries, 1977.

Organization for Economic Cooperation and Development. Information Submitted by USAID. 1977.

Organization for Economic Cooperation and Development. Report of the Working Group on Rural Road Transport Planning in Developing Countries, Part II. State of the Art Report. 1977.

Orata, Pedro T. "Community Education in Rural Philippines." Overseas Education, April 1954, pp. 12-14.

Owen, Wilfred. Distance and Development: Transport and Communications in India. Washington: The Brookings Institution, 1968.

Owen, Wilfred. "Road Transportation and Food Production." Highway Research Record 125 (1966):1-10.

Park, Sei-Yung. "Transportation and its Role in Socio-Economic Development." Reproduced from the Proceedings of the ITC UNESCO Seminar on Transportation Problems and Integrated Surveys, April 22-26, 1968. Delft: The Netherlands.

Practical Concepts, Inc. "Patterns in Rural Roads Projects" for PPC/AID. Washington: Practical Concepts, Inc., 1979.

Prest, A. R., and Turvey, R. "Cost-Benefit Analysis: A Survey." Economic Journal 75 (1975):683-731

Redfield, Robert. A Village That Chose Progress. Chicago: University of Chicago Press, 1950.

Richmond, Anthony, and Kubat, Daniel. Internal Migration: The New World and the Third World. Beverly Hills: SAGE Studies in International Sociology, 1976.

Sansom, Robert L. The Economics of Insurgency in the Mekong Delta of Vietnam. Cambridge: MIT Press, 1970.

Schuster, Helmut. "Agricultural Roads". EDI Seminar Paper Series, No. 7. Washington: International Bank for Reconstruction and Development, 1973.

Squire, Lyn. "Optional Feeder Roads in Developing Countries: The Case of Thailand." Journal of Development Studies 9 (1973):279-90.

Stanley, William R. "Evauating Construction Priorities of Farm-to-Market Roads in Developing Countries: A Case Study." The Journal of Developing Areas 5 (1971):371-400

Steiner, Henry Malcolm. "Criteria for Planning Rural Roads in a Developing Country: The Case of Mexico." Report EEP-17. Stanford: Institute in Engineering-Economics, 1965.

Steiner, Henry M. "Mexican Social Roads." International Development Review VIII. 3 (1966):21-24.

Stoeckeler, Joseph H. "Drainage Along Swamp Forest Roads, Lessons from Northern Europe." Journal of Forestry 63.10 (1965): 772-76.

Stokes, Charles J. Transportation and Economic Development in Latin America. New York: Frederick A. Praeger, 1968.

Sullivan, James B., and Montgomery, Paul A. "Surveying Highway Impact." Environment 14.9 (1972):12-20.

Tendler, Judith. "New Directions Rural Roads." AID Program Evaluation Discussion Paper No. 2. Washington: USAID, 1979.

Thomas, John Woodward, and Hook, Richard M. Creating Rural Employment: A Manual for Organizing Rural Works Programs for AID. Harvard: Harvard Institute for International Development, 1977.

Thompson, Virginia. French Indo-China. NY: Macmillan Co., 1937.

Tripathi, Prakesh Chandra. Rural Transport and Economic Development. Delhi: Sultan Chand, 1971.

University of Edinburgh. Transport in Africa. Edinburgh: University of Edinburgh, Centre of African Studies, 1969.

Walters, A. A. The Economics of Road Users Charges. World Bank Staff Occasional Papers No. 5. Baltimore: The Johns Hopkins University Press, 1968.

Wennergren, E. Boyd, and Whitaker, Morris D. "Investment in Access Roads and Spontaneous Colonization: Additional Evidence from Bolivia." Land Economics 52 (1976):88-95.

White, H. P. "Communications and Transport.: Selected Readings to Accompany Getting Agriculture Moving, Vol. II. Raymond E. Barton, ed. New York: The Agricultural Development Council, Inc., 1972 pp. 799-801.

Workshop on Low-Volume Roads, Boise. National Reserve Council, Transportation Research Board Special Report 160. Washington: National Academy of Science, 1975.

World Employment Programme. The Kenya Rural Access Roads Programme. Report of the Joint Donors Review and Evaluation. Geneva: World Employment Programme, 1978.

Zedalis, J. P. "Classification of Rural Roads." (Draft) Washington: USAID, 1979.

Impact Assessments

Bird, Ralph, Project Officer. Project Evaluation Summary for Bicol Secondary and Feeder Rds, Project #492-0281 by USAID/Philippines 2nd yr. Evaluation. August 1979.

Blaikie, Piers; Cameron, John; and Seddon, David. "The Relation of Transport Planning to Rural Development: The Implications of Road Construction in Nepal." Planning, Transport Planning and Highway Design in Developing Countries. London: Planning and Transport Research and Computation, 1977.

Blaikie, Piers, Cameron, John, and Seldon, David. "The Effects of Roads in West Central Nepal, Part I (Summary)." A report to ESCOR, Ministry of Overseas Development, 1977.

Blair, James A. S. "The Regional Impact of a New Highway in Sierra Leone." African Environment 3.2 (February 1978): 49-76.

Blair, James A. S. "Regional Impact of Tonkolili-Koro Highway-Seminar on Implications of Development on Population." University of Sierra Leone, Institute of African Studies, 1 (1975):138-171.

Bonney, R. S. P. "The Place of Transport, Particularly Road Transport in the Economic and Social Development of North Borneo." Proceedings of United National Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas, E/Conference. n.p., 1962

Bonney, R. S. P. "The Relationships Between Road Building and Economic and Social Development in Sabah." Drayton, England: Road Research Laboratory, Ministry of Transport, 1964.

Brokensha, David, Moock, Peter, and Riley, Bernard. "Kenya Rural Access Roads and Gravelling, Bridges and Culverts Program - Consultants' First Annual Report" (Draft). Washington: Devres, 1979.

Carnemark, Curt. "Mexico: Case Study of a Rural Roads Program and its Interface with the Local Communities." World Bank, 1979

Cook, Peter, and Kurzman, Harold. "Evaluation of Research Program on the Impact of Low-Class Roads Upon Rural Development." East Orange: Louis Berger International, 1976.

Corbett, V. F. "The Implementation of a Socio-Economic Priority Ranking Scheme in the Evaluation of Ethopian Rural Road Programmes." Planning, Transport Planning and Highway Design in Developing Countries. London: Planning and Transport Research and Computation, 1977.

Cornwell, P. R. "Some Aspects of the Measurement of the Impact of Feeder Roads in West Africa." Transport Planning in Developing Countries. London: Planning and Transport Research and Computation, 1978.

Daines, Samuel R. Impact Evaluation of the Small Farmer Improvement Project. New York: Practical Concepts, Inc., 1979.

Ellis, Richard A.; Kuoka, Gladys, M.; and MacDonald, Vicki Morey. "Liberia Rural Roads Study, Vol. II. Socio-Economic Baseline Report." Washington: Checchi and Co., 1975.

Hackenberg, Beverly H. "Research Report: Impact of Infrastructure on the Changing Economic Lives of Women in Southeast Mindanao." Davao City, Philippines: Davao Research and Planning Foundation, Inc., 1978.

Harris, Frederick R., Inc. "Evaluation of CARE Feeder Road Project, Final Report." New York: Frederick R. Harris, Harris, Inc., 1977

Hecht, Alfred. "The Agricultural Economy of the Mennonite Settlers in Paraguay: Impact of a Road." Ekistics 42.248 (1975):42-7. Growth and Change, October 1975 pp. 14-23; reprinted.

Hilewick, Carol Lee, Deak, Edward J., and Heinze, Edward. "Investment in Communications and Transportation: Socio-Economic Impacts on Rural Development." in Information Societies: Comparing the Japanese and American Experiences. Alex S. Edelstein, John E. Bowes and Sheldon M. Harsel, eds. Seattle: University of Washington Press, 1978.

Hofmeier, Rolf. Transport and Economic Development in Tanzania. Munich, 1973.

Hoskins-Western-Sonderegger, Inc. "Final Report: Labor Intensive Road Program, Small Farmer Development Project, Haiti." Lincoln, Nebraska: Hoskins-Western-Sonderegger, Inc., 1978.

Hughes, William. "Social Benefits Through Improved Transport in Malaya." Transport and National Goals. Edwin T. Haefele, ed. Washington: Brookings Institution, 1969.

India, Ministry of Transport and Communications. Economic Benefits of Ramnad-Mandapam Road, 1959-60. India: Department of Transport, Road Wing, 1961.

Jones, John Hugh. "Economic Benefits from Development Roads in Thailand." (SEATO Graduate School of Engineering Technical Note 15, 1964).

Kasiraksa, Wisit. "Economic Effects of the Friendship Highway." Thesis Number 41, SEATO Graduate School of Engineering Bangkok, Thailand, 1963.

Ketteringham, William. "Amazonian Roads and the Brazilian Economic Miracle." Fullerton: California State University, 1979.

Larsen, Flemming. "Effects of Road Network on Economic Development." Socio-Economic Planning Sciences 2.1 (1968):1-14.

Leinbach, Thomas R. "Feeder Road Impact Within the Rural Works Program," Jakarta, n.p., 1978.

Luning, H. A., and Sterkenburg, J. J. "A Social Cost-Benefit Analysis of Road Building for Agricultural Development." (Tanzania). Journal for Agricultural Economics 24 (1973):311-318.

Louis Berger International, and Rahman and Associates. "Rural Roads Study Phase II Final Report, Vol. I, Faridpur District." For Government of the People's Republic of Bangladesh, Ministry of Local Gvoernment, Rural Development and Cooperatives. East Orange, NJ: Louis Berger, International, 1979.

Louis Berger International. "Study of Transport Investment and Impact on Distribution of Income in Remote Areas, Phase I Final Report." For Southeast Asian Agency For Regional Transport and Communications Development and USAID. East Orange, NJ: Louis Berger International, 1979.

Mitchell, Brigitta. "The Socio-Economic Impact of Road Access: A study of the Andapa Basin, Madagascar." The Courier 54 (March-April 1979):82-3.

Mitchell, Brigitta, and Rakotonirina, Xavier. "The Impact of the Andapa - Sambava Road: A Socio-Economic Study of the Andapa Basin, Madagascar, Vol. I and II." Washington: The World Bank, Transportation Department, and Democratic Republic of Madagascar, Ministry to the Presidency of the Republic in charge of Finance and Planning, 1977.

National Research Council, National Academy of Sciences; and National Academy of Engineering. Summary and Evaluation of Economic Consequences of Highway Improvements. National Cooperative Highway Research Program Report 122, 1971.

Okada, Ferdinand E. "Rural Works Project Padat Karya Gaya Baru: Socio-Economic Assessment." Report prepared for USAID/Indonesia, March 1978.

Patrick, Arthur V., Guiot, Howard, and Airey, Antony. "Sierra Leone/CARE Feeder Roads II, First Annual Evaluation Report." Liberia: USAID, 1978.

Permanent International Association of Road Congresses. Proceedings of Fifteenth World Road Congress. Mexico: n.p., October, 1975.

Plumbe, A. J. "Implications of Feeder Road Usage by the Farming Community of South-East Thailand." Transport Planning in Developing Countries. London: Planning and Transport Research and Computation, 1978.

ROCAP. "Economic Evaluation of Three Integration Roads Financed with ROCAP/CABEI Funds." A ROCAP Report, 1977.

Santos-Villanueva, Patrocinio. "The Value of Rural Roads." Selected Readings to Accompany Getting Agriculture Moving, pp. 775-798. Edited by Raymond E. Borton New York: The Agricultural Development Council, 1966.

Schroeder, Mark C. W., and Sisler, Daniel G. "Impact of the Sonauli-Pokhara Highway on the Regional Income and Agricultural Production of Pokhara Valley, Nepal." Ithaca, NY State College of Agricultural and Life Sciences. Cornell International Agricultural Development Bulletin 14, 1971.

Shaner, W. W. "Economic Evaluation of Investments in Agricultural Penetration Roads in Developing Countries." Highway Research Record #180, pp. 120-132.

Shaughnessy, Daniel, Roth, Daniel, Roth, Alan, Stack, Michael, and Brundin, Hsalmar. "Special Evaluation of the USAID/CARE Food for Relief Work Program." Dacca: USAID/CARE, 1978.

Smith, N. D. S. "A Pilot Study in Uganda of the Effects Upon Economic Development of the Construction of Feeder Roads." Research Note 3408, Road Research Laboratory, 1959.

Stokes, Charles J. "The Economic Impact of the Carretera Marginal de la Selva." Traffic Quarterly, 1966, pp. 302-26.

USAID/Philippines Provincial Development in Cooperation with Department of Local Government and Community Development, Rural Roads Program. "Rural Roads Evaluation Project." Philippines: USAID, 1978.

USAID. "Project Evaluation Summary: Disaster Relief - Arusha Region Dought." Tanzania: USAID, 1979.

van der Tak, Herman G., and de Weille, Jan. Reappraisal of a Road Project in Iran. World Bank Staff Occasional Papers No. 7. Baltimore: The Johns Hopkins Press, 1969.

Vialet, Ted. "Summary of the Rural Roads Evaluation Report in the Philippines." (Memorandum). Washington: AID, July 6, 1979.

Ward, Marion W. The Rigo Road: A Study of the Economic Effects of New Road Construction. New Guinea Research Bulletin No. 33. NG Research Unit, The Australia National University, Camberra and Art Mosesby, 1970.

Way, J. M. "Roads and the Conservation of Wildlife." The Journal of the Institution of Highway Engineers XVII.7 (1970):5-11.

Weiss, Joseph. The Benefits of Broader Markets Due to Feeder Roads and Market News in Northeast Brazil. Cornell University Latin Am. Series 24. 1971.

Wilson, George W., Bergmann, Barbara R., Hirsch, Leon V., and Klein, Martin S. The Impact of Highway Investment on Development. Washington: The Brookings Institution, Transport Research Program, 1966.

Appraisals

Bos, H. C., and Koyck, L. M. "The Appraisal of Road Construction Projects, A Practical Example." The Review of Economics and Statistics 43.1 (1961):13-20.

Carnemark, Curt, Biderman, Jaime, and Bovet, David. "The Economic Analysis of Rural Roads Projects." World Bank Staff Working Paper No. 241. Washington: IBRD, 1976.

Foreign Economic Development Service. Improving Marketing Systems in Developing Countries. An Approach to Identifying Problems and Strengthening Technical Assistance. FEDS Staff Report #7. Washington: Foreign Economic Development Service, U.S. Department of Agriculture, Cooperating with the U.S. Agency for International Development, 1972.

Hansen, Charles E. "Evaluation of Planned Road Construction in Liberia: Quantitative Analys6s of Socio-Economic Data." Vol. 1 New York: Checchi and Company, June 1, 1976.

Hine, J. L. "The Appraisal of Rural Feeder Roads in Developing Countries." In Transport Planning in Developing Countries, London: Planning and Transport Research and Communication, 1975.

Koch, Janet A., Moavenzadeh, Fred, and Chew, Keat Soon. "A Methodology for Evaluation of Rural Roads in the Context of Development." Low Volume Roads: Second International Conference. Washington: National Academy of Sciences, Transportation Research Record 702, 1979.

Louis Berger International. "Methodology for Establishing the Economic Viability of Low-Volume Roads." Worldwide Projects. April-May 1978.

Muller, T. "Labour-Intensive Methods in Low-Cost Road Construction: A Case Study." International Labour Review 101.4 (1970):359-75.

Ramp, Rudy, et al. "CARE/Sierra Leone Penetration Roads, Evaluation." USAID/Monrovia, 1977.

Sychrava, L. "Some Thoughts on Feasibility Studies, Occasioned by the Appraisal of Road Projects in Thailand." Journal of Transport Economics and Policy II. 3 (1968): 332-48.

USAID. "Paraguay Rural Roads Project Paper." Washington: USAID, 1978.

Walters, A. A. "A Development Model of Transport." American Economic Review 58 (1968):360-75.

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ANNEX 2

LIST OF SOURCES CONSULTED

An attempt has been made in this survey of the literature to include as many evaluation studies as could be located as well as pertinent works in appraisal methods and more general works dealing with road projects and their impacts. In the process, the following sources were explored, some of which were more useful than others.

Institutions:

Anthropology Resource Center (ARC)
Brookings Institution
CARE
Centro de Estudios de Transporte (CETRAN), Facultad de Economia, Universidad Nacional de Cordoba, Argentina
Inter-American Development Bank (IDB)
International Bank for Reconstruction and Development (IBRD)
International Center for Research on Women (ICRW)
International Labour Organization (ILO)
International Road Federation (IRF)
Library of Congress
National Academy of Science - Transportation Research Board (NAS/TRB)
Organization of American States (OAS), Washington, D.C., Rural Development Projects
Organization for Economic Cooperation and Development (OECD)
The Road Research Laboratory (TRRL), Crowthorne, England
United Nations Development Programme (UNDP)
United Nations Economic Commission for Latin America (UNECLA)
University of Maryland, McKeldin Library
U.S. Agency for International Development (USAID)
U.S. Department of Transportation (DOT)

Publications:

Dissertation Abstracts
Ekistics Journal
Geo Abstracts

Individuals:

G. William Anderson (AID)
Oswaldo Bellini (OAS)
Richard Braida (DOT)
David Brokensha (Devres - UCSB)
Curt Carnemark (IBRD)
Lloyd Crowther (NAS/TRB)
Dr. Jasper Ingersoll (Catholic U., Department of Anthropology)
Karla Jones (ARC)
Tina Kimes (IBRD)
Ossie Rahkonen (IBRD)
Bernard Riley (Devres - UCSB)
Judith Tendler
Charles Vandervort (DOT)
Ted Vialet (AID)
Mr. Yerrell (TRRL)

ANNEX 3

TERMS OF REFERENCE

Scope of Work

1. Survey the literature--both the academic literature and reports and evaluation documents published by IBRD, AID, OECD, ILO and other international organizations—to ascertain what is known and what major unanswered questions remain regarding the socio-economic impact of low-volume rural road projects financed by AID and other aid donors.

2. Note the degree of attention given to and agreement in the literature regarding the impacts of rural road projects on:

- o level of agricultural production
- o activity of local businesses and industries
- o transportation costs and trucking patterns
- o recurrent cost obligations at local, regional and national levels
- o income of small producers (farmers, craftsmen, and businessmen), men and women, truckers, and others
- o land values and land ownership
- o size of forested area and degree of soil erosion
- o spread of schools and other training programs
- o spread of health services
- o local capacities for self-development
- o physical mobility and migration patterns
- o social roles
- o short-term and long-term employment

3. Prepare a final report that includes the following:

- o an analytical review of the literature
- o the major unanswered questions on socio-economic and environmental impact of rural road projects
- o the types of evidence needed to settle these issues

- suggestions regarding the unsettled issues for which evidence is most likely to be available from rapid field visits in PPC/E's interregional evaluation study of rural roads projects
- indications of the links, if any, between the impact issues identified and
  - (a) the institutional setting
  - (b) the choice of construction technology (i.e., degree of labor use)
  - (c) road selection criteria
  - (d) the maintenance of roads, and
  - (e) technical design issues